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WINERY & VINEYARD

MAY/JUNE 2000

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24 VARIETAL REVIEW Crafting California Barbera

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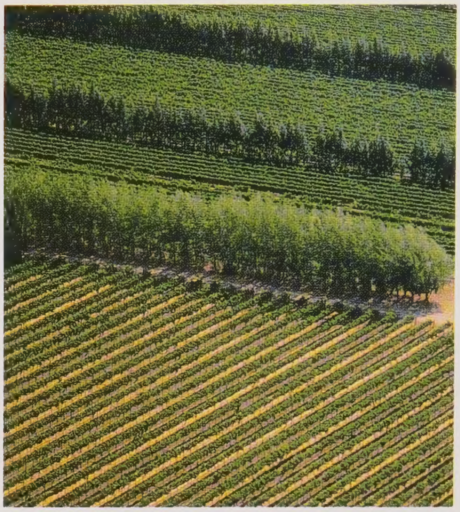

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By: Fred Lyon

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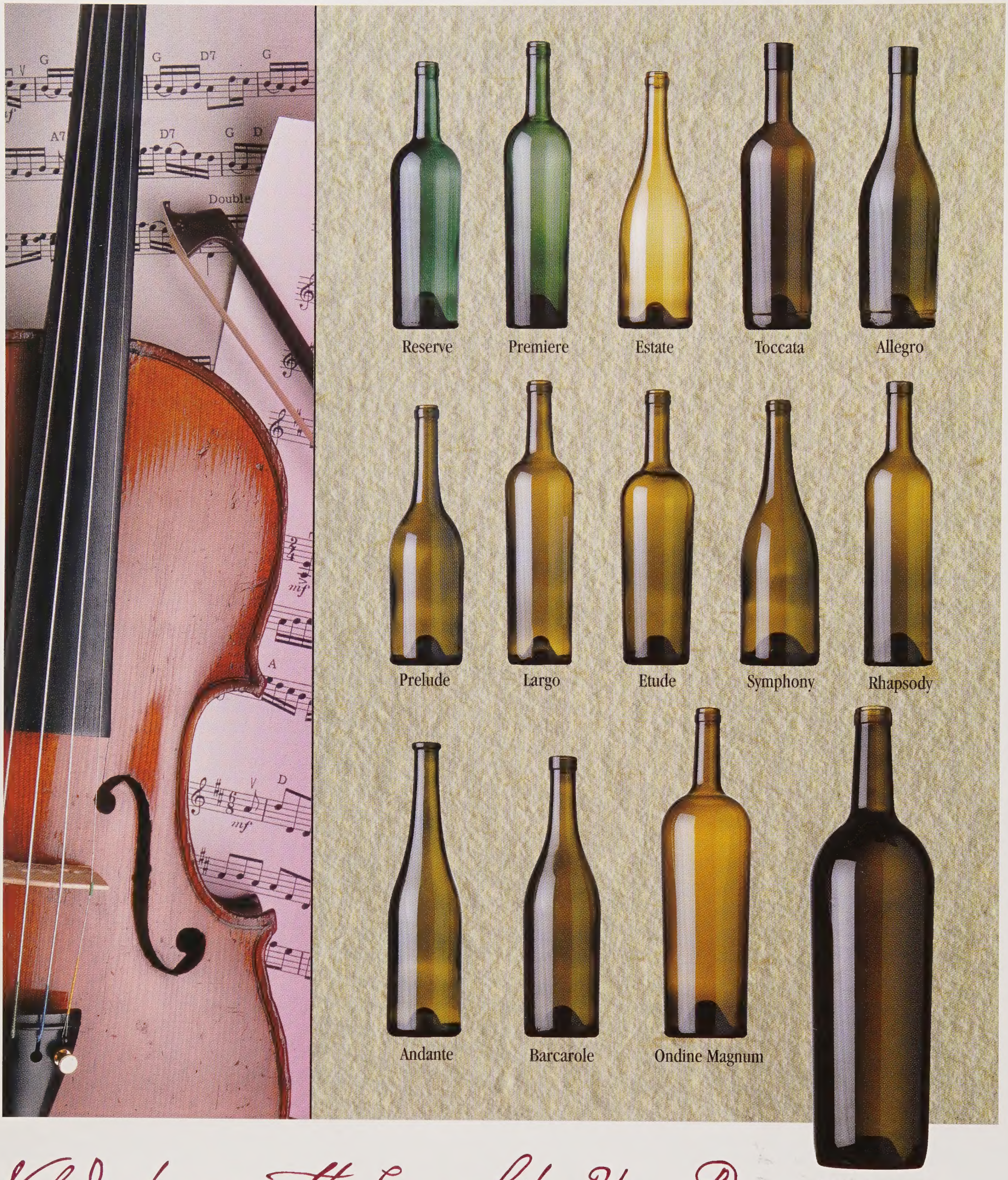

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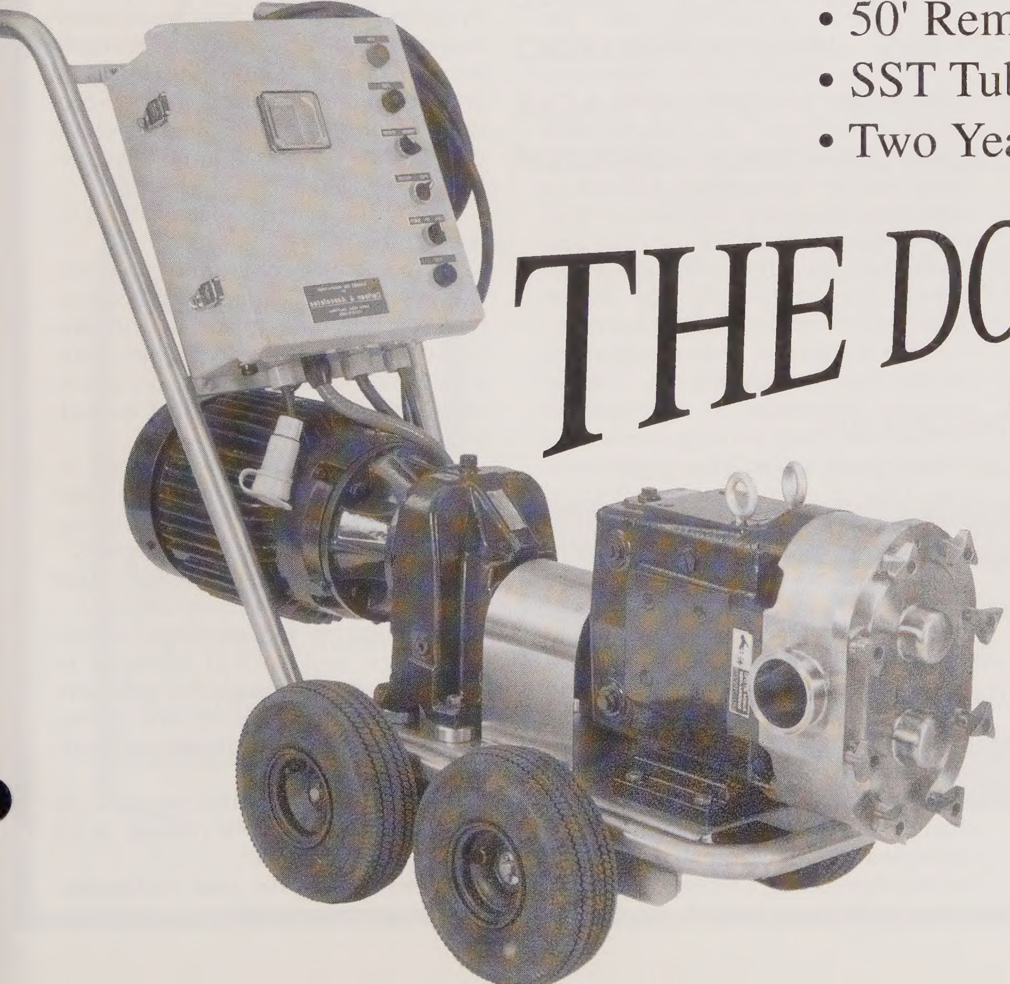

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WineVision: A map for the future

BY Carol Caldwell-Ewart,
Associate Publisher

Truth is, the Aussies started it all with *their* vision of the future. "We will drown you!" they said, in a sea of high-quality Australian wine. "Nothin' personal, y'know, mate. It's just that the U.S. has the biggest potential market with the most money to spend. We'd be fools not to target your market!" And so, a crucial factor in the Australian wine industry's current 20-year strategic plan is to bowl over the U.S. consumer with a fire hose of Australian wine imports.

A decade or two hence, this challenge may be seen as the best thing that ever happened to the U.S. wine industry, because it inspired leaders in many segments of the industry to begin working together in March 1999 to develop their own 20-year strategic plan.

In January, at the Unified Wine and Grape Symposium in Sacramento, CA, Paul Dolan, president of Fetzer Vineyards, Hopland, CA, revealed a proposed draft of the 20-year strategic plan, called "WineVision, American Wine in the 21st Century." Participants hope to complete the plan by June.

The plan is being developed by the WineVision Steering Committee — Paul Dolan; David Freed, UCC Vineyards Group, Napa; Jerry Lohr, J. Lohr Winery, San Jose, CA; and Bill Turrentine, Turrentine Wine Brokerage, San Anselmo, CA — representatives from all the wine industry trade groups, and more than 400 individual participants.

They have used study groups, surveys, and a two-day retreat to determine where the industry is now, where it wants to be, and how will it get there collectively.

"It is not the intent of the WineVision strategic planning process to start a new organization," says Dolan. The idea is to "provide a platform for an industry-wide strategic plan to be implemented by existing organizations and individuals."

Now, to the if-it-ain't-broke, don't-fix-it school, it may seem that there's no need for a strategic plan. As Dolan points out: "The U.S. wine industry is strong and healthy, enjoying profitability and the highest revenues in our history. Domestic consumption of wine has increased with the booming economy, and consumers are trading up for higher wine quality at higher prices. The industry is working together better than ever, with a strong commitment and passion for our product and our industry.

"But the U.S. wine community is facing rapid change at an accelerating pace." New technology and the Internet, global competition, and global consolidation give ever-more sophisticated consumers access to a growing selection of international wines. Getting them to choose U.S. wines will be increasingly difficult as marketing gains new emphasis worldwide. (Futurist Faith Popcorn has predicted that "by 2010… 90% of all consumer purchases will be home delivered" — ordered off the Internet.)

More worrisome, Dolan explains, is the fact that the industry has "lost the research advantage to international competitors. There are large increases in varietal plantings in California and overseas. There is a resurgence in efforts to force greater regulation of wine, beer, and spirits. Environmental and social impact concerns have brought increasing calls for restrictive regulation of vineyard and winery development, and the public is largely unaware of the industry's actual record on these issues."

In addition, the industry does not have access to the marketplace data, news, and information it needs.

WineVision proponents say these changes make a long-range, industry-wide plan with a coordinated approach toward developing a more competitive U.S. wine business critical.

The WineVision plan

The basic goals of the WineVision strategic plan are:

- To become the leader in sustainable practices — environmentally, socially, and economically by developing and facilitating the wine community's adoption of a broad-based, voluntary code of environmental responsibility and encouraging support from the rest of the supply chain; by anticipating and avoiding future sustainability problems; and by investing in research to build a sustainable infrastructure.
- To make wine an integral part of the American culture — by expanding the acceptable wine occasions across the demographics of alcohol-consuming segments of the population and by defining a public identity for the American wine community.
- To position U.S. wines as the high-quality, high-value product (across price points) in global markets targeted for the greatest prosperity: by developing and implementing a U.S. wine-positioning strategy (*e.g.*, high-quality, high-value product across price points); by facilitating broader and easier distribution of U.S. wine to global markets; by reducing or eliminating tariffs in one-half of the producing and non-producing nations; by reducing or eliminating trade barriers in more than one-half of the U.S. market.

A fourth goal has been added in recent months:

- To enhance community-wide (industry-wide) communication, coordination, and marketplace information by working to improve communication inside and outside the industry and to improve domestic and global marketplace information.

The plan has been developed to address several factors that have been identified as essential to the wine industry's success over the next two decades:

- Creating an image of U.S. wine that will enhance consumer demand
- Facilitating industry-wide coordinated legal and political strategies to address resurgent anti-alcohol sentiment
- Enhancing the distribution system
- Eliminating global and domestic trade barriers
- Maximizing relationships with stakeholders and public officials at all levels of government
- Developing the best sustainable environmental practices

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Five-year WineVision objective

In the shorter term, the first five-year objective of the WineVision strategic plan is for wine community members to work together to make the U.S. wine industry "the preeminent supplier to the global marketplace, growing U.S. wine community revenues to $? billion by December 31, 2005." The actual dollar amount of this goal has yet to be set.

Achieving this goal will first require industry trade groups to commit to the 20-year strategic plan and develop trade-association task forces to begin to implement it, says Dolan.

Future success requires strategic planning

PWV commends the work of WineVision proponents. We agree that thoughtful planning and a united front are crucial elements in the wine industry's future success. In an industry whose total revenues are less than those of many U.S. corporations, image building, market growing, and political tactics must be a group effort.

WineVision Conference

WineVision invites industry members to a conference covering the plan's implementation July 6, 2000, at the American Center for Food, Wine and the Arts, Beringer Atrium, in Napa, CA. Phone 707/255-9222 or 800/927-6272 for more information. ■

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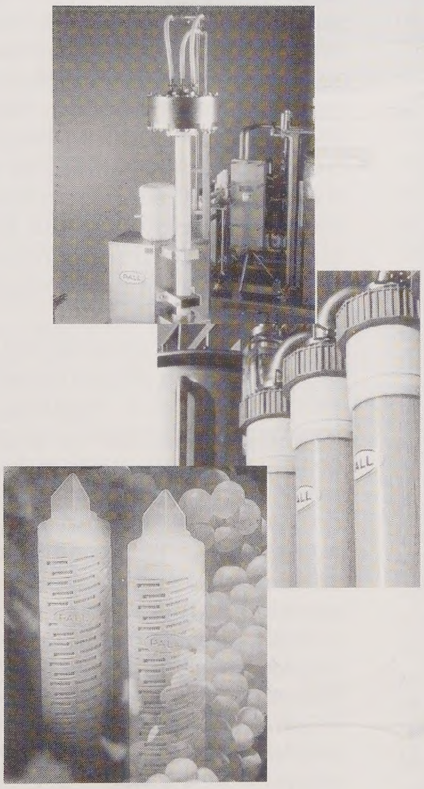

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Wineries vulnerable to workplace violence

BY Ed Kempkey, President
Kempkey Risk Management Services
Napa, CA

As alarming as it may sound, violence in the workplace is a serious safety issue facing wineries, particularly those with a tasting room. Wineries with tasting rooms are at higher risk because of two factors that have been identified as increasing a worker's risk for workplace assault — serving alcohol and the exchange of money.

National statistics point out the real dangers employers cannot afford to ignore. According to the U.S. Bureau of Justice Statistics, more than two million people become victims of violent crime at work each year. Every work day, an estimated 16,400 threats are made; 723 workers are attacked, and 43,800 are harassed. A 1999 Pinkerton survey found that workplace violence was the leading security threat facing corporate America.

Violence is a serious safety and health hazard in many workplaces. According to a Northwestern National Life Insurance Company survey, 3% of employees have been physically attacked in the workplace, 7% have been threatened, and 19% have been harassed. The report adds that 44% of workplace attacks were committed by customers, 24% by strangers, 20% by co-workers, 7% by bosses, and 3% by former employees.

CAL/OSHA report

According to a California Occupational Safety and Health Administration (CAL/OSHA) report, the circumstances associated with workplace violence in California can be divided into three major types.

Type I involves people who have no legitimate business relationship with the workplace and usually enter the affected workplace to commit a robbery or other criminal act. In California, most workplace homicides involve a person entering a retail establishment, like a tasting room, to commit a robbery. During the commission of the robbery, an employee is killed or injured.

An example of this took place recently at a Napa Valley winery, where a tasting room employee was confronted at knifepoint and instructed to empty the cash register. This occurred just prior to closing time, and fortunately, the employee was not physically injured in the process.

Type II workplace violence events involve fatal or nonfatal injuries to individuals who provide services to the public, such as tasting-room personnel who serve visitors and customers at the winery. The fact that they are serving alcoholic beverages increases their risk. Of particular concern to tasting room management should be the group of visitors that shows up later in the day, obviously having had more than enough alcohol and demanding more.

This problem occurred at another Napa Valley winery in 1999, and resulted in an altercation with an intoxicated visitor. Additional issues, such as injury to other customers, can also be of concern in cases such as this.

Type III workplace violence involves employment-related events. Usually this involves an assault by a current or former employee, supervisor, or manager; by an employee's current/former spouse or lover, relative, or friend; or by some other person who has a dispute with an employee of the affected workplace.

In 1992, a California jury awarded $5.5 million to the family of a Sonoma County winery employee who was stabbed and killed by a fellow employee. Because it had failed to conduct the necessary pre-employment background checks, the winery did not know that the accused employee was a convicted murderer.

Plan a system for safety

Protecting employees, avoiding costly litigation, preserving the winery's reputation, and improving the bottom line are all good reasons for wineries to be concerned about workplace violence.

Now, more than ever, winery management must pay attention to establishing and maintaining a workplace security and violence prevention plan. Effective January 1, 2000, Assembly Bill 1127 provides for a substantial increase in employer fines and other penalties for violations of workplace safety regulations. Of even greater concern from a liability standpoint, this new law permits OSHA standards to be used in civil proceedings to establish or define standard of care.

This means employers will be held accountable if a workplace injury does occur as a result of violence and there is no prevention program in place. According to CAL/OSHA, employers who are at risk for Type I events are required to address workplace security hazards to satisfy the regulatory requirements of establishing, implementing, and maintaining an effective Injury and Illness Prevention (IIP) Program. Employers at risk for Type I (as well as Types II and III) events must include as part of their company's IIP Program:

- A system for ensuring that employees comply with safe and healthy work practices, including ensuring that all employees, supervisors, and managers comply with work practices designed to make the workplace more secure and do not engage in threats or physical actions that create a security hazard to other employees, supervisors, or managers in the workplace.
- A system for communicating with employees about workplace security hazards, including a means that employees can use to inform the employer of security hazards at the worksite without reprisal.
- Procedures for identifying workplace security hazards including scheduled periodic inspections to identify unsafe conditions and work practices whenever the employer is made

aware of a new or previously unrecognized hazard.

- Procedures for investigating occupational injury or illness arising from a workplace assault or threat of assault.
- Procedures for correcting unsafe conditions, work practices, and work procedures — including workplace security hazards — with attention to procedures for protecting employees from physical retaliation for reporting threats.
- Training and instruction about how to recognize workplace security hazards, measures to prevent workplace assaults, and what to do when an assault occurs, including emergency action and post-emergency procedures.

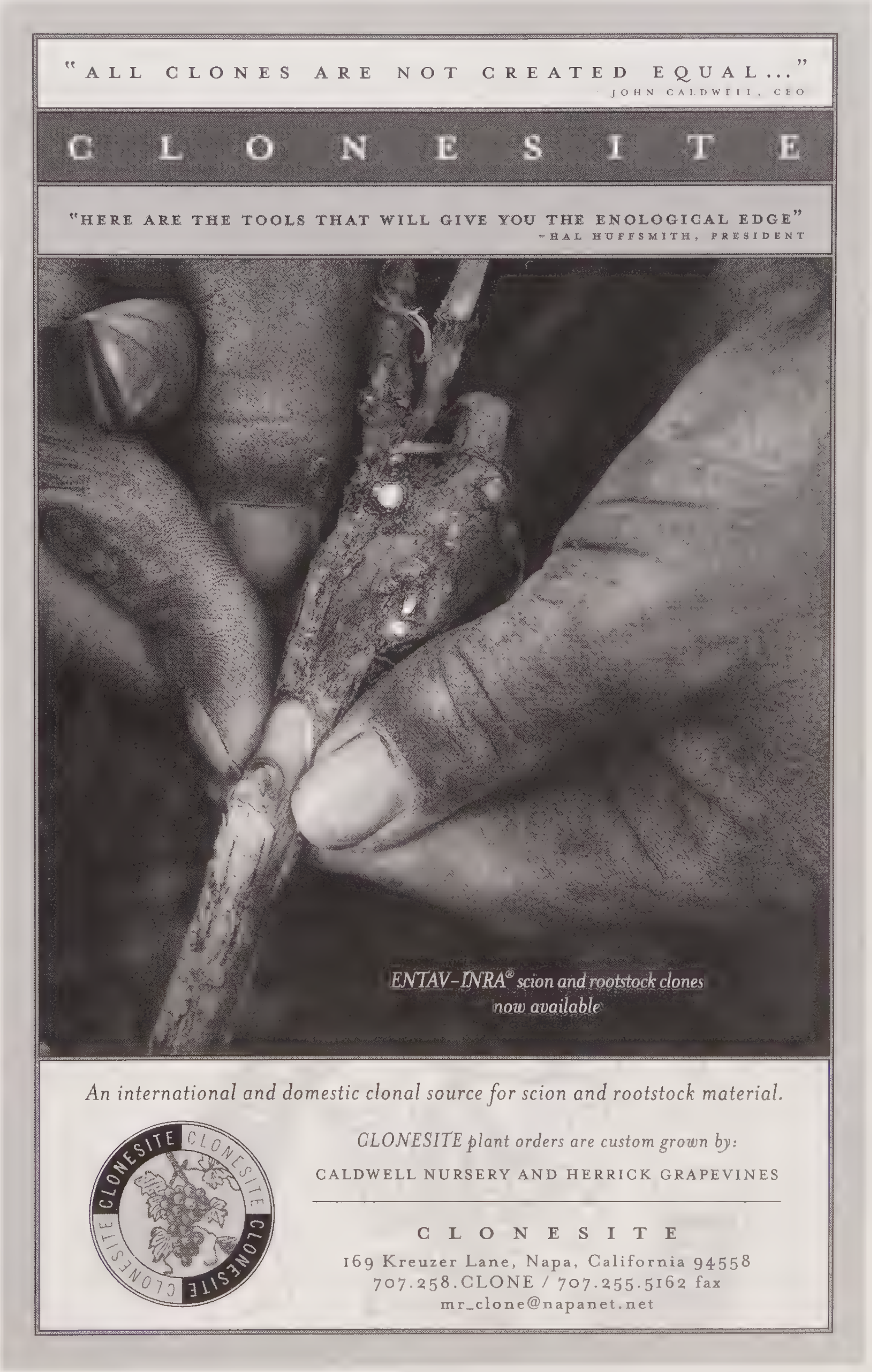
Steps for protecting your winery

There are a number of steps management can take to address workplace violence. Experts agree that efforts in these areas will make any workplace safer.

1. Provide support from top management. Senior management's commitment should be more than a vague agreement to go along with the project. It should include their willingness to take action, including discipline and training, and to support the necessary policies and procedures. This support is vital because it lends credibility to the entire program, and because senior management's behavior is likely to be reflected in that of managers, supervisors, and employees at each level of the company hierarchy. If top administrators brush off the program, you can't expect anyone else in the company to take it seriously.

2. Form an executive committee. The executive committee charged with implementing and administering the Workplace Violence Prevention Program should include representatives from various departments within the winery. The committee's first order of business is to agree on the program's mission and objectives. It is essential that committee members realize that some tasks can only be achieved through cooperative inter-departmental efforts. The next step is to draft company policies, procedures, and regulations for approval by senior management. Once approved, great care should be exercised to clearly communicate these policies, procedures, and regulations to all employees.

3. Perform a risk assessment. Before the executive committee gets down to recommending policies and procedures, it must do an assessment of "what is." The saying "Before you can get where you're going, you have to know where you are" has much validity in the design of an effective Workplace Violence Prevention Program. One method for accomplishing this is to develop a simple survey and give it to all employees. It should ask if, in the workplace, they have ever witnessed aggressive behaviors, if they



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know of someone who has been assaulted or intimidated, or if they have ever been victimized. Questions along these lines will identify "hot spots" in the organization.

4. Educate employees. The cornerstone of an effective workplace security plan is appropriate training of all employees, supervisors, and managers. Employers with employees at risk for workplace violence must educate them about the risk factors associated with the various types of workplace violence and provide appropriate training in crime awareness, assault and rape prevention, and defusing hostile situations. Also, employers must instruct their employees about what steps to take during an emergency incident.

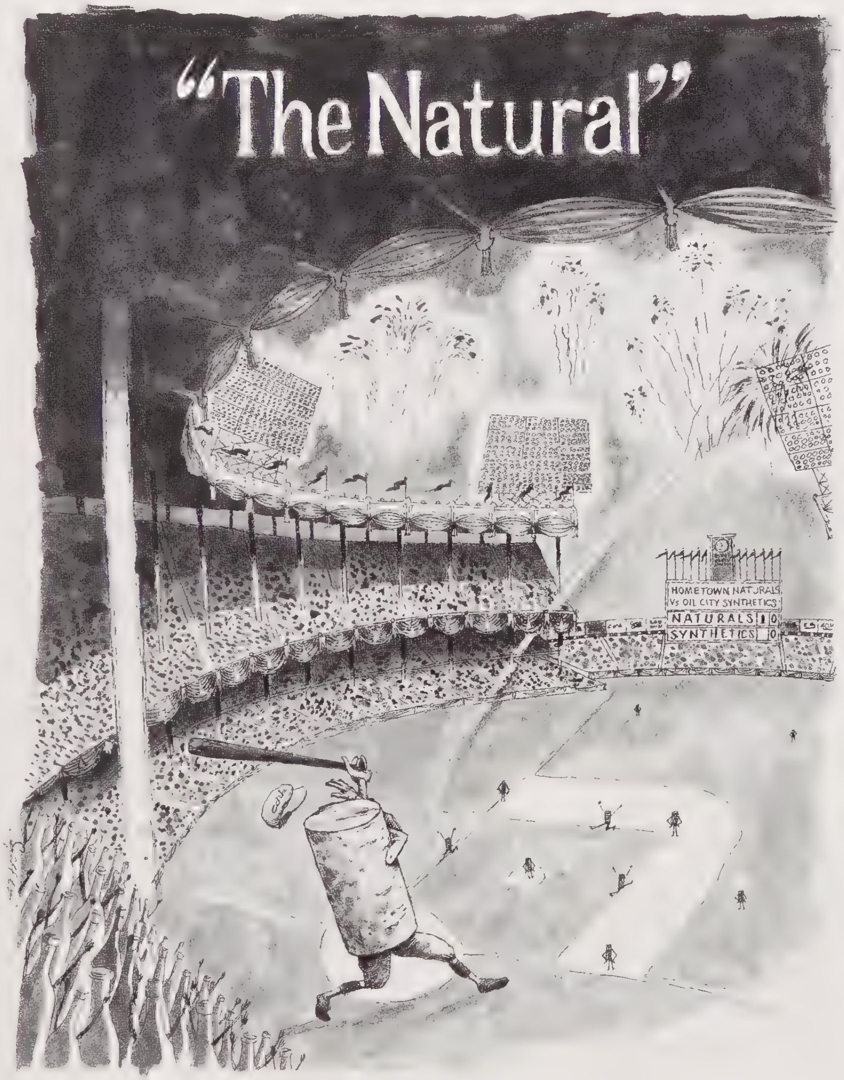
5. Develop policies for hiring as well as terminations. An extensive screening process for the winery designed to root out potential "problem employees" should be utilized. This may include interviews, background checks, and reference checking. The process does not end with the hiring. The new employee must be made familiar with company rules and regulations and the consequences of not following them. Equally important is the termination process. The single biggest trigger of rampage-type attacks by employees in the workplace is termination. How the firing is done can make the difference between a routine event and a crisis.

6. Develop a crisis plan. Despite all the best planning, policies, and practices — and despite dealing fairly with all employees and having a model prevention program — an incident can still happen. What can be done then? Plenty, if you have planned for it. A crisis-response plan detailing the steps to be followed is necessary. Not only is a response plan effective for workplace violence, but also for other human-made or natural disasters, such as a chemical spill or an earthquake. The plan should outline the duties required to respond to a crisis properly. An effective plan involves all departments.

Information Resources

CAL/OSHA provides an excellent resource on the subject of workplace violence, including a model program for workplace security. Much of this information can be accessed via the Internet at *www.dir.ca.gov/DOSH/dosh_publications/iipsecurity.html.* Another excellent resource, the Workplace Violence Research Institute, has information available at *http.//workviolence.com.* For more general information about risk management, including workplace violence, visit *www.kempkey.com.*

While it may not be a safety issue we commonly think about, workplace violence occurs every day. Ignoring the statistics won't make them go away. Everybody who earns a living has a right to a safe and secure work environment. The best thing a winery can do to protect its employees and its customers is implement a workplace violence prevention program ■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Future value of the vineyard in Sonoma County

BY Pete Opatz
Sonoma County Grape Growers Association President (1999-2000)
Vineyard Manager, Clos du Bois Winery, Geyserville, CA

Times are changing for winegrowers in Sonoma County, CA. Public support for the wine industry as the county's environmental and economic showpiece can no longer be taken for granted. As growers, we can't afford to isolate ourselves from the increasingly diverse voices in the community, nor from our relationships with the public, regulators, and elected officials.

Let me get right to the point. I think we have an obligation to the community, and we've fallen short in response to its concerns. Sooner or later, we're going to see the impact of this failure in changed economics of grapegrowing in Sonoma County. It's going to hit us right in the wallet, or more precisely, the balance sheet.

Consider this:

Selections from a *Santa Rosa Press Democrat* poll in 1999 showed an 81.7% positive attitude toward grapegrowing.[1] This may give you a sense of security, but it shouldn't. We can't afford to be complacent. More than half of the respondents (52%), stated that more regulation is required,[2] and 45% expressed concern about the environmental impact of vineyards.[3] A majority (53.4%) stated that they fear there will be too much acreage planted in grapes in Sonoma County.[4]

The clamor is only getting louder. Questions are coming from 8,000 local households represented by the Sonoma County Conservation Action Committee (state executive director — Mark Green), plus several hundred participants in recent Town Hall Coalition (THC) meetings. Even the right-to-farm ordinance is under attack.

Critics may be in the minority but the message is reaching the public. They're telling us we're not getting the job done, and they're getting organized. They're having fundraisers. They're bending the ears of local, regional, and national media, conducting press tours and issuing sound bites.

From Oregon to San Diego, from the Alexander Valley to Schellville, vineyards — whether they're run by wineries or independent growers — are under increasing public scrutiny. Sometimes this scrutiny reveals bad practices that reflect poorly on all of us. Responsible growers are right to support penalties against the relatively few growers who fail to meet safety and environmental regulations.

But the scrutiny means something more: it's questioning the usefulness of our industry and our life's work. If we're not careful, we are going to feel the impact in our professional and personal lives.

Grapegrowers owe the community more than an explanation of what we're doing. We owe them a justification for our existence.

Opposition to grapegrowing is not going away. But the public needs to hear the other half of the story. They've put their positions on paper. Some of those positions concern me very much. Our critics will continue lobbying from sunup to sundown for change, such as local regulation of pesticides.

The THC has taken its show on the road, and people throughout Sonoma County are exposed to their fear-creating rhetoric. Their methods include media and regulatory pressure, half-factual appeal to emotion, and a laundry list of social, environmental, and economic concerns tied to vineyard development.

The ripple effect will spread to other grapegrowing communities and other agricultural enterprises. If you believe it can't happen to you, consider this: it already has in San Luis Obispo County.

As growers, we have to overcome our own resistance to recognizing problems and accepting change. We've long basked in the perception of expansive market opportunities for new development of premium vineyards, with the expectation that ultimately the market itself will be the only limit on our growth.

Admittedly, we were unprepared for opposition from our own community. Our business has never been this good in my lifetime, but for it to continue, we must recognize we are farming in a new era. It's time to get over our righteous indignation, our social and political isolation. It's time to reach out and meet our neighbors.

Growers shouldn't lament. They should get involved, speak to their

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[1] *Question 1:* Overall, do you feel the wine industry has a positive impact or a negative impact on the quality of life here in Sonoma County? 81.7% replied positive.

[2] *Question 18:* Do you feel that there should be more controls or limits placed in planting vineyards? 52% replied yes.

[3] *Question 21:* Do you have concerns about the impact of vineyards on the environment? No: 51.4%. Yes: 44.6%. Uncertain: 3.9%

[4] *Question 17:* Are you concerned that, in the future, there will be too much acreage planted in grapes in Sonoma County, or do you not think this will be a problem? Will not be a problem: 42.2%. Will be too much: 53.4%. Uncertain: 4.4%.

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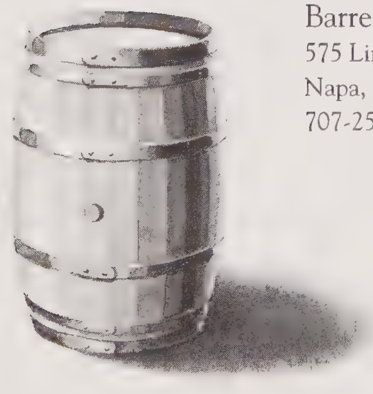

neighbors, and communicate with boards of supervisors. We have to bring the community along with us.

There's a new equation in the valuation of Sonoma County vineyards, and it will forever change the way we do business. The risk to growers is diminishing returns in the long term. Even as our value diminishes, our costs will continue to rise, squeezing out all but the lowest cost producers. Most insidiously, the erosion of value may not be felt until too late — when the next generation has lost its rights to farm.

Methods for valuing the vineyard asset are changing. Formerly we consulted our income statement, asking: what are our costs? yield? quality? weather and pest risk? price paid for grapes?

As growers make development and management choices, we must include the risk of environmental impacts including groundwater resources, habitat, and air and water quality, risk of workforce safety, and pesticide and herbicide use. To these, I would add risk to our relationships with present and future neighbors; and, finally, aesthetic risk.

Today, we have to ask an additional set of questions as we implement our farming plans. These questions relate to an expanded definition of our balance sheet.

How significant is the new balance sheet variable that quantifies social and environmental risk? How can I prevent long-term social and environmental damage? How do I assess the impact of new vineyard development or the selection of pest control methods? How do I plan to mitigate these risks? How do I reassure my neighbors that I am farming responsibly, and that I am concerned about their comfort and safety as well as my family's livelihood?

Add to your balance sheet the variable reflecting environmental and social risk, and you'll see a new equation emerging — one that puts a different value on your vineyard. Today, you must look out for the interests of the environment and your neighbors as much as for those of your grape buyers, your family, and your successors. ■

PART IV

BALANCING

Yield and Quality

Close spacing on Oakville soils

BY **Jordan Ross**

Conventional wisdom says that the highest density vineyards make the most sense in Bordeaux and Burgundy because the vines are so constrained by the poor, low vigor soils that they can never grow big. With low yields per vine, the vines are spaced as close as possible to attain economically viable yields.

In more fertile soils, where the vine wants to grow big and be productive, close spacing can result in dense canopies close to one another, requiring higher canopy management costs to prevent shading and poor air circulation. But Robert Mondavi's apparent success with high density plantings in Oakville, CA, suggests that it is possible to replicate the Bordeaux and Burgundy planting densities on considerably deeper and richer soils under completely different conditions.

Few wineries have made the commitment to close spacing that Robert Mondavi has. The winery has high-density vineyards (1.2mX1.2m) planted to Bordeaux varieties, Pinot Noir, Chardonnay, and Sauvignon Blanc.

"The concept of a low-vigor vine is the key," says Andy Bledsoe, vice president of winegrowing at Robert Mondavi, Inc., explaining that conditions needed to achieve a low vigor vine include the proper combination of rootstock, spacing, and grape variety matched to the appropriate soil type."

Robert Mondavi began researching rootstocks in the early 1980s, long before the Napa Valley's problems with phylloxera became apparent. "We were evaluating some of the newer rootstocks compared to the old ones planted more commonly throughout California," recalls Bledsoe. The older rootstocks (AXR-1 and St. George) were selected for viticultural performance, that is high vigor, high yield, drought tolerance, and ease of growing.

"They produced big, strong vines that could be planted far apart (8x12), and they could fill up space between vines. The vineyard was fully productive in its fifth year. But when we looked at it from a wine quality standpoint — in particular for red varieties — we found pretty strong evidence that lower-vigor rootstocks produced smaller vines and wines that were more intense, deeply colored, with more emphasis on fruit flavors than on vegetal flavors."

Using the concept that a smaller vine makes better wine, Robert Mondavi began to replant with lower-vigor rootstocks. "One side effect of the smaller vine is less yield per vine, less brush, and fewer leaves," notes Bledsoe. "On bilateral cordon trained-vines spaced 8x12, the cordon arms of the smaller vines could not fill the space between the vines because of their diminished capacity for growth, but they made better wine. So we increased vine density to compensate for this difference." Although rootstock was the starting point, Bledsoe maintains that it is merely a building block. "Vigor management is the foundation, rootstock and spacing are components. We use 101-14, 3309C, and 420A rootstocks on fertile, clay loam soils to help control vigor."

Bledsoe adds that the next critical component is irrigation or, more accurately, soil moisture management. "With increased vine density, root density increases — effectively every cubic inch of the soil is mined by roots. Once the vines deplete the soil moisture supplied during the winter, they slow down on their own and run into a deficit. They experience stress earlier in the season than with a wider spacing regime.

"This stress turns the switch from growing (vegetatively) to ripening fruit — producing sugar, phenolic, and aroma compounds that make up quality. Once deficit is reached, it's managed by supplemental irrigation, so the vine doesn't totally collapse or decline. Vineyards with wider tractor rows offer a larger reservoir of soil moisture for vine roots to explore, allowing vines to continue growing later in the season. Cover crops are used, but why plant a cover crop to use up the water? We don't make wine from a cover crop. We plant an extra row of vines to induce that early season water deficit."

By adopting traditional French planting densities to Oakville soils, Robert Mondavi is bucking traditional California viticultural practice. Not all grapegrowers agree this is wise.

Dr. Nick Dokoozlian, (UC Davis Department of Viticulture & Enology) explains, "The concept of how vines are spaced is based on anticipated vine vigor. The French plant vineyards 1m x 1m because of low soil vigor; they plant high density in order to achieve an economical yield."

By using less irrigation and low-vigor rootstocks, Robert Mondavi is fine-tuning a system to make it fit their strategy. Dokoozlian adds, "The people at Robert Mondavi are putting their money where their mouth is. I totally respect them, they are doing something they think is right. I don't agree with their strategy, but I admire their commitment."

Bruno Prats, (recently retired from Chateau Cos D'Estournel, Saint Estephe, Estephe, France) reacts to Robert Mondavi's high density approach saying, "I am convinced that 1m x 1m in California is not appropriate, that is my belief. It is not right, because the soil is far too rich and the vigor of the vine is too big. With such a high density, there is a problem with one row shading the neighboring row. The density has to be adjusted to local conditions."

As for adopting French techniques, Prats advises, "What needs understanding is not French technique but French philosophy, which is to find the techniques that are appropriate to each individual location. Vine density in the Medoc is higher than it is in Pomerol, because soils are different. The spacing is much wider in Chateauneuf-du-Pape, because it is much drier than the Medoc. Each technique has been developed to match the characteristics of the local area — the same has to be done in California."

Bledsoe continues, "Most people are not planting vines as closely as we do; they don't share our experience and they don't believe in denser planting. We are not shying away from close planting. Our primary focus is to grow reserve quality wines. With close spacing (1.2mX1.2m), we have been able to do this in the Oakville area with Cabernet Sauvignon with yields of five to six tons per acre. If the definition of overcropping is delayed maturity, these vines are obviously not overcropped, because our closest spaced vineyards are the first to ripen in their respective areas."

Tony Soter, Etude winemaker, Napa, CA, has reservations about close spacing. "Close spacing in California almost always results in too much crop for quality wine results; thinning becomes mandatory. This is less an issue in 'marginal' climates, such as Oregon and northern Europe, where fruitfulness is usually much lower.

"Very close spacing (meter by meter) is an answer to limited fruitfulness, but it comes with its own set of problems, such as a higher probability of mildew and other rots. This spacing also puts the fruit closer to the ground and requires vertical shoot positioning, resulting in leaf-crowding and overexposed fruit, which often takes on a baked quality in a heat wave."

Dr. Richard Smart, international viticulture consultant, is also a proponent of wider spacing. To contend with a high potential site, he would not increase vine density to reduce vigor. He recommends reducing vine density to allow the vines to spread out and express their vigor. The resulting larger vines require a more elaborate trellis system to efficiently array the foliage and grape clusters to intercept sunlight and maximize air circulation.

Smart adds that vine balance, and related canopy and water management are far more important in affecting wine style, quality, and price point than are either vine density or yield. Vine density is but one of many, many tools to affect quality, and a relatively inefficient one at that. High density vineyards are only appropriate to low potential soils. Smart agrees entirely with Bruno Prat's sentiments.

Bledsoe responds, "I think that is an appropriate approach when the primary goal is far higher yield (eight to 10 tons per acre) and keeping the wine price low

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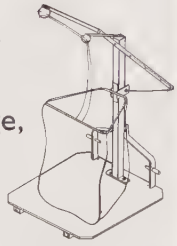
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to be more successful on the world market. That is not what we are trying to do with our close-spaced vineyards in Napa Valley. We are trying to make wines that compete with the top wines of the world, and we do want to put limits on the expression of vigor. Because, by concentrating the vine's energy, you do get concentration of flavors."

But for strictly economic reasons, closer spacing is winning adherents. In a tight market for grapes, growers can rely on higher vine density to produce a crop in the second or third year compared to the six to eight years that wider spacing takes to achieve full production (particularly with a quadrilateral trellis). No one is certain which technique will make better wine, but Robert Mondavi is convinced that closer spacing will.

Irrigation

All grapevines need water to survive. If it doesn't come as rainfall during the growing season as in Bordeaux and Burgundy, it must be added via irrigation as in California. The exception is old vines whose roots get their water from deep in the subsoil. Oregon receives summer rain but still needs irrigation to survive heat spells. Nonetheless, irrigation conjures up images of overcropping. Since these images do not sell wine, they are seldom discussed. Non-irrigation or dry-farming evokes images of stressed vines and low yields which are perpetuated in the wine press because they do sell wine.

Irrigation also conjures up images of overcropping. Robert Mondavi's work shows that soil moisture management is a critical factor in ripening in areas where there is little or no rainfall during the growing season. Even in Oregon, where there is summer rain, the ability to irrigate is crucial to prevent vine stress. Non-irrigation or dry-farming produces stressed vines and low yields. But again, opposition to irrigation is inherited from the French, because irrigation is illegal there.

Gary Andrus, owner of Archery Summit Winery, Dundee, OR, has observed the trend toward irrigation in Oregon. "Everything in Oregon until recently has been dry-farmed. It's the new people coming into Oregon — King Estate, Willakenzie Winery, and our winery — planting new ground with high density spacing, who have installed irrigation, and it's catching on. The irrigation system is put in to establish the vines, and if you need it later, it's available."

Successful vine establishment is a big economic concern, because at $3 each, the grafted vines are five times the cost and considerably more fragile than their own-rooted predecessors. "We're planting 2,000 to 4,000 vines per acre, you don't want to lose them," notes Andrus.

Aside from vine establishment, irrigation has other important uses as

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well. "In Oregon, we get a heat spell every August or September," explains Andrus. "In 1994 and 1998, this occurred just as the grapes were reaching maturity. The numbers (sugar, acid, pH) were all looking right, but the flavors had not really developed. The acids were dropping, the sugars were shooting up, the fruit was starting to shrivel, and everyone was panicking and picking as fast as they could.

"We knew the flavors weren't there, so we turned on the irrigation and gave the vines a blast of water, which prevented the grapes from dehydrating and shriveling. The brix went down, because we hydrated the fruit, but then we turned the irrigation off and let the grapes hang on the vine for another two weeks. The flavors developed, the sugar and acid numbers were almost the same as before, and it was wonderful wine."

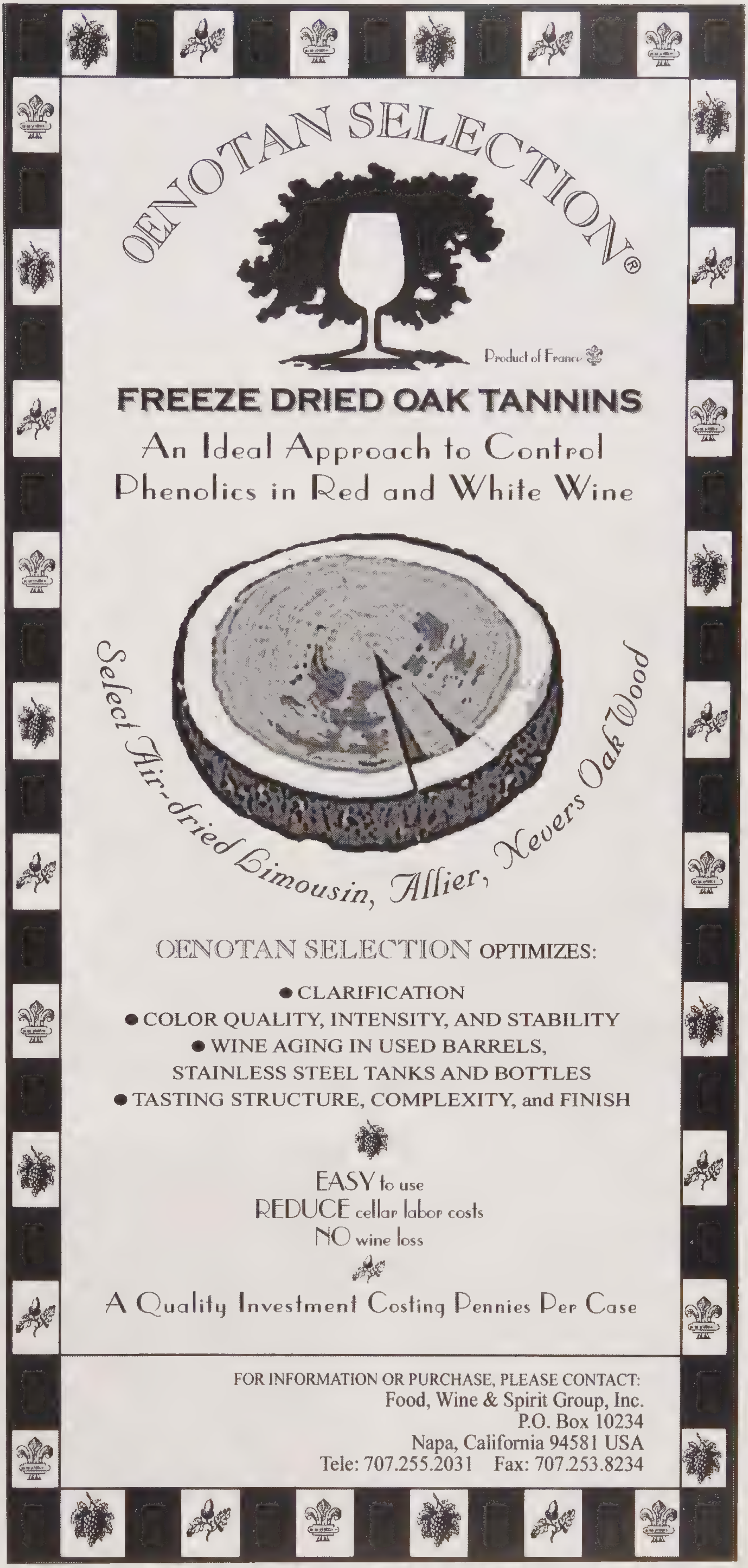
Justin Meyer, owner of Silver Oak Cellars, Oakville, CA, cites drawbacks of dry-farming: "On the entire west side of Napa Valley (west of Highway 29), it is very hard to find water. As a result, many of these vineyards are dry-farmed — surviving on 35 inches of rain in an average year. In a year like that, you don't need supplemental moisture.

"But in a drought year, like 1976 and 1977, those vines not only suffered in quality, but their yield was down because vines ran out of moisture and shriveled up. Maybe half a crop of poor quality was harvested because the grapes tended to be raisiny. In a situation like that, you wish you had water.

"When people say that irrigation is bad for quality, you can be sure of one thing, they don't have irrigation." But Meyer acknowledges that growers can over-irrigate. "If growth never slows down because there is too much water, then the fruit probably won't get ripe. Vines have competition between vegetative growth and fruit maturity, and at some point, a grower must stop growth by not irrigating, so that vines will slow down or stop growth and ripen the fruit."

Ted Lemon, owner/winemaker of Littorai Wines, St. Helena, CA, agrees that irrigation can be crucial: "Stress due to lack of water — dehydration —

Continued on page 91



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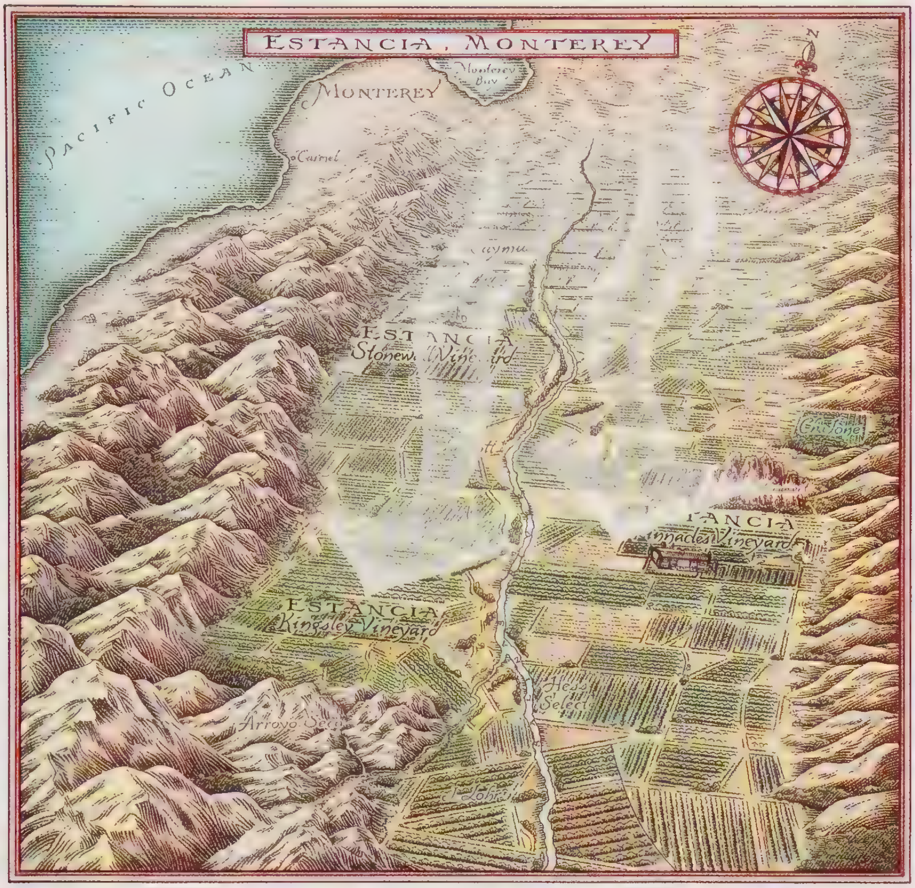

Prevailing winds at Estancia Estates vineyards blow from the Northwest (Monterey Bay).

Windbreaks mitigate climate

BY Don Neel

Nearly every afternoon in Soledad (Monterey County) on California's Central Coast, the wind rises and blows steadily and strong from the northwest for several hours. In 1987, when Franciscan purchased the 800-acre ranch east of Soledad that is now Estancia Estates, this wind was a factor that Howard Tugel, general manager (vineyard manager until 1998), knew had to be dealt with if the vineyard was to produce high-quality grapes.

In 1988, during redevelopment of the 660 acres originally planted by Paul Masson in 1961–62, Estancia planted windbreaks of *Casurina* trees to protect the grapevines. Spaced one meter apart and almost 50 feet tall after nearly 12 years, the trees reduce the wind impact significantly.

When winds measure 20 to 25 mph outside the windbreaks, they are only 12 mph inside. Winds of 7 to 10 mph are reduced to 3 to 5 mph inside the windbreaks. As a result, Estancia has achieved a consistent set every year.

Windbreaks offer many benefits. They reduce leaf tatter, sandblast desiccation, and wind damage to growing tips. Protected grapevines produce greater leaf area with larger leaves, longer shoots, higher pruning weights, increased vine capacity, longer internode length, improved pollination and fertilization, improved berry set, and improved stomatal conductance and photosynthesis. Evapotranspiration is improved and water stress is reduced.

Estancia reports increased bunch weight with more berries per bunch and increased bunch number per vine. In addition, time to grape maturity is reduced by as much as two weeks

Peter Figge (L), vineyard manager, and Howard Tugel (R), general manager, report higher yields from grapevines protected by windbreaks. (Photos by Fred Lyon)

Triticale cover crop is planted in every tractor row with new vine planting to reflect heat and improve growing conditions for new vines. In the fourth year, every other tractor row is cultivated.

compared to unprotected neighboring vineyards.

Windbreaks improve irrigation efficiency, and they improve spraying conditions by allowing a 10-hour spray day despite surrounding winds. Spraying of two or three vine rows can be done with an over-the-row air-blast fan system mounted on a Braud harvester chassis.

Windbreak establishment

In the first tree-protected vineyard section of 104 acres planted in 1988, a row of *Casurina* seedlings six to eight inches tall was planted every 500 feet. The tree rows are parallel to the vine rows of Clone-4 Chardonnay on 5C rootstock, which are east-west oriented and spaced 10x6.

In addition, cross rows of Australian willow trees were planted in three main avenues and along the outside perimeter of the ranch to protect the vines from the potential wind channeling effect. Two rows of the willow trees were planted five feet apart in a staggered pattern with 10 feet between

This effective windbreak of *Casurina* trees has grown to over 40 feet tall.

Shown much larger than actual size below is the face of a Roman antoninianus, a coin minted during the reign of emperor Probus (pictured) circa a.d. 276 to 282. A great lover of wine, Probus led conquests into Gaul and found a region he believed held great potential for vineyards. He instructed his men to cultivate the ground and with perseverance succeeded in making truly unique wine. His men weren't as enthusiastic, and eventually killed him out of a rage for being forced to make agriculture instead of war. Those original vineyards were the seeds for the terrain known today as the Bordeaux region of France.

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trees. They are 35 feet from grapevines and have grown to be 40 to 50 feet tall. "Our goal was to achieve a 'boxed in' vineyard as seen commonly in New Zealand," explains Tugel.

"We planted *Casurina* trees within the vineyard because leaf-out occurs early enough in the growing season to provide protection when grapevine budbreak occurs. We did not want willows in the vineyard itself because they have a shallow, spreading root system. Also, willows are deciduous, and we did not want to end up spraying fallen willow leaves when trying to control weeds."

Within the vineyard in 1991, a 45-acre block of Chardonnay was planted with north-south oriented vine rows spaced 8x4. Rows of *Casurina* trees were planted 250 feet apart. Tugel says new vines are spaced 6 feet 3 inches by 5 feet, and tree rows are being planted every 250 feet because their experience has taught them that this spacing gives the most effective windbreak protection.

Resulting vineyard sections are 250 feet wide, 1,200 or 1,600 feet long, with trees surrounding six to nine acres of vines. In general, the area protected by the trees extends 10 to 12 times the height of the windbreak on the leeward side and three to five times the height of the windbreak on the windward side.

Vine rows are planted no closer than 15 feet on each side of the row of *Casurina* trees. The trees are laterally pruned in February or March up to 12 feet high to improve tractor access to the vines. *Casurina* trees grow four to eight feet in height per year and have a maximum circumference of about three feet.

Casurina trees

Casurina is a tall, evergreen Australian tree, commonly called the river she-oak. It has a tap root rather than a filamentous root system and has dark green branchlets, which are jointed and look like pine needles, allowing some blow through. The tree has separate male and female flowers, and when the female flowers mature, they resemble small pine cones. Seeds are small, winged nutlets.

The *Casurina* tree tolerates alkali and saline soils, is drought resistant, and will withstand strong prevailing winds. It tolerates temperature to 15°F, or colder if it is well watered. Periodic cultivation is recommended to reduce competing vegetation and improve planting survival and growth. At least two discing passes in the tree row are needed each year for weed control. The trees receive the same fertilization as grapevines through the drip irrigation system.

Every winter for the first five to seven years after planting, Estancia prunes the tree roots at about four to six feet on either side of the tree row, using a four-foot deep single shank pulled by a D68U Caterpillar tractor at 3 to 3.5 mph. Older trees are root-pruned on one side of the tree row only (alternated each winter).

Yield benefits

The most important benefit of planting windbreaks at Estancia is told in the resulting grape yields. An 85-acre Estancia vineyard block grafted to Chardonnay in 1988 that has **not** been protected with windbreaks has internode lengths of less than ¾-inch and yields only 2.5 to 3 tons per acre.

But in the tree-protected vineyard sections, reports vineyard manager Peter Figge, "The yield from Pinot Noir is 5.5 to 6 tons per acre, from the Clone-4 Chardonnay is 6 to 7 tons per acre (11 to 15 pounds per vine), and from Pinot Gris is 5 to 6 tons per acre."

Tugel and Figge agree that this boost in yields validates the use of windbreaks in their vineyard. ■

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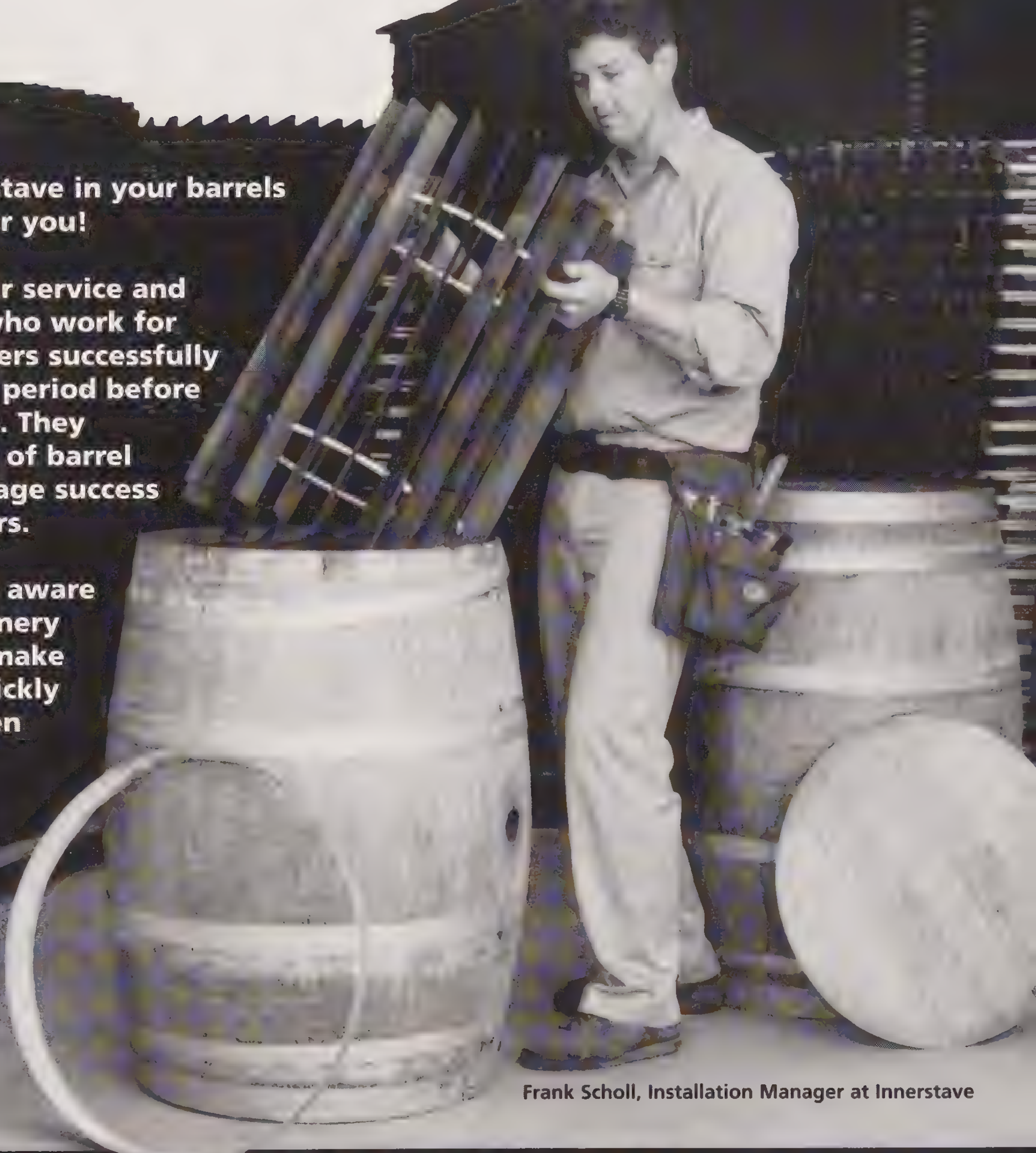

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Crafting California Barbera

BY Eleanor & Ray Heald • Contributing editors

California Barbera producers are crafting unique interpretations of this Cal-Ital variety. They are striving for a rich, mellow, yet extracted wine style with deep color, as opposed to the traditionally leaner, more acidic style long preferred in Italy's Piedmont, where the grape originated.

Winemakers in this exclusive *PWV* varietal review say they want their Barbera to exhibit varietal character, but more importantly, want it to taste good, capturing pure, juicy, lively red fruit without aggressive tannins or noticeable wood from extended oak ageing or over-use of new oak.

Their challenge is to craft a flavorful, full, expressive, and opulent wine that is enjoyable in its youth — a wine in balance, with an undercurrent of oak flavor that enhances the fruit. They consider their Barbera style a contemporary of the new-age, highly-stylized Barbera some Piedmont producers have released over the last few years.

Looking back over the past three years, these winemakers believe they are producing a better Barbera and attribute this to a number of viticultural improvements, including selection of optimal sites offering reasonable yields; removal of leaves and small shoots; cluster thinning, especially where clusters are tightly packed; and longer hang time, which lowers acidity and allows grapes to achieve full maturity.

Some winemakers have chosen to limit skin contact to no more than 21 days as a cellar improvement contributing to wine depth and complexity. But there are proponents of extended maceration of 35 to 40 days with excellent trial results. Puncheon and cask ageing with early rackings allows cellaring without pick-up of barrel tannins, making it possible to bottle young.

Revise and shine

Greg Boeger (Boeger Winery, Placerville, CA) sources Barbera from the 18-acre Ritchie Vineyard in El Dorado leased by Boeger, which has 35-year-old, own-rooted vines spaced 8x12 and 8x8. He believes that the vineyard's original budwood was sourced from Sebastiani Vineyards (Sonoma, CA).

Participating producers:

Greg Boeger, owner/winemaker
Boeger Winery, Placerville, CA

Heather Pyle, winemaker
La Famiglia di Robert Mondavi, Oakville, CA

Jim Moore, owner/winemaker
la Pantera
L'Uvaggio di Giacomo, Napa, CA

Greg Graziano, owner/winemaker
Monte Volpe Vineyards, Redwood Valley, CA

Marco DiGiulio, winemaker
Pepi Winery, Oakville, CA

Paul Sobon, winemaker
Shenandoah Vineyards, Plymouth, CA

Sonia Rued, assistant winemaker
Seghesio Family Vineyards, Healdsburg, CA

In this vineyard, Barbera vines grow fairly tall and are head-pruned with two-bud spurs. Cluster thinning is imperative where the vines are in heavier soils. Yields for Boeger typically run 3.5 to 4 tons per acre (TPA).

In better soils, Barbera tends to produce clusters that group together and nest. Over the past three years, Boeger has been doing more suckering and other hand work to open vines to sunlight and air penetration.

Boeger approaches the viticulture of a Barbera vine as he would a fruit tree. Bunches need to be well spaced, because if they are touching, they do not color evenly. "A significant amount of vine energy goes to attempting to ripen bunches that never will because they are too crowded," Boeger says. "Because I've learned the habits of Barbera, I believe a bilateral cordon would work as well as head pruning."

Boeger considers Barbera a late ripening variety, but notes that his vineyard efforts early in the season pay off at harvest time, because ripening occurs earlier.

"One might assume that removing photosynthetic potential retards maturity," he adds. "However, this has not been my experience. In addition, with improved vineyard care, we have achieved lower total acidity at harvest (0.80-0.90 TA) for a grape variety that tended, in prior years, to have acidity in the range of 1.0 to 1.1 TA."

Both Boeger and Marco DiGiulio (Pepi Winery, Oakville, CA) agree that tannins and phenolics are not problems with Barbera.

Paul Sobon's (Shenandoah Vineyards, Plymouth, CA) experience in Amador County at Dick Cooper's vineyard has only been with head-trained Barbera, spaced 9x9. "Everything that Boeger does in the vineyard, Cooper does," Sobon remarks. "This is also true for other growers in the area. The most important thing we've learned is that 16 to 20 spurs must be left on a head-trained vine to get an economical crop."

Appropriate crop levels

With Barbera, if there is insufficient crop, the vine is unbalanced and bunches will not ripen. Sobon notes that if crop level is below 2.5 to 3 TPA, acidity will not be moderated to an acceptable level. With a low crop, sugars come up fast, but the acid is way too high.

Sobon has also seen the same scenario in other vineyards, and based on this experience, he recommends crop loads of at least 3.0 TPA. "The situation is replicated in Amador County," he adds, "because most vineyards are planted with a slightly-virused selection. It is not a heat-treated, certified production clone."

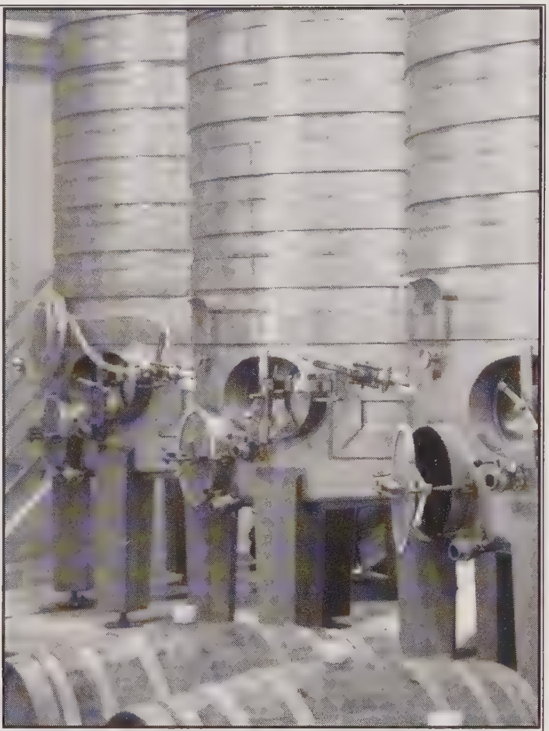
To compensate, Sobon notes, many Amador producers leave kicker canes on all bilateral cordon-trained vines to increase crop levels. Without them, sugars must climb to 30° Brix before the acid is sufficiently moderated.

On the other hand, Jim Moore (L'Uvaggio di Giacomo, Napa, CA) notes that kicker canes are used routinely at one of his sources — Kunde's Wildwood Vineyard in Kenwood, CA — to throttle crop load on a younger more vigorous vineyard block that is spaced 8x12 and yields up to 6 TPA with reasonably good maturity.

Kicker canes also help maintain an economical crop load on a weaker site in an older more virused block at Kunde, which is also spaced 8x12 and yields 3.5 TPA maximum.

Heather Pyle (La Famiglia di Robert Mondavi, Oakville, CA) sources Barbera throughout California, in vineyards where vine age varies from three to 40 years. Vine spacing, yields, and row direction also vary widely. New plantings are spaced 6x7 with a vertical trellis (VSP).

Older vines are head-pruned, while newer plantings are on VSP. Post-veraison fruit thinning is a routine practice on older vines, while selective hedging is preferred for younger, VSP vines. Younger vines exhibit a more uneven set than older ones.



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La Famiglia's new Barbera hillside vineyards on clay loam are in the Stags Leap District of Napa Valley. While early results are positive, Pyle believes nothing can substitute for vine age with Barbera.

To achieve a lush, tart style without substantial tannins, yet retaining mouth-filling and mouth-watering qualities, Pyle cites two key issues: vines 40 years old and older and vineyard location with high daily temperatures prior to veraison through about 19° Brix maturity development.

"For good color development and smaller berries, the sky's the limit on temperature as far as I'm concerned," Pyle emphasizes. "Beneficially, this location should have an early autumn or one that simulates early autumn conditions.

"The Sierra Foothills and some other areas of California have cool nights, relatively early in the ripening cycle (around September 15th in most years). These conditions aid in producing a great Barbera. Coolness later in the season promotes the fresh fruit characters and tends to keep sugar accumulation in check so that some acidity can respire before picking."

Moore contends that a slightly higher yield allows the grapes to hang longer without significant sugar accumulation. Better maturity is achieved, and the acid level does drop. In severely-virused blocks, acidity respires before there are appropriate sugar levels with flavors to match.

Style predictions

Moore first became interested in Barbera in 1989. At that time, the most notable vineyard was Kunde's Wildwood. Back then, there were only about 34 acres of Barbera in all of California's north coast, and Wildwood had half that acreage.

Graziano grows some of his Barbera and Boeger grows all of his. Boeger sells some of his grapes to Robert Mondavi and to Jim Moore. How does a grower come to an agreement with a customer on which blocks will be sold?

"Greg Boeger cares about customer's grape purchases because he knows that his product will be represented in a competitor's wine," Moore emphasizes. "He lets me buy some of the really good stuff, but that's somewhat subjective. The 'really good stuff' is very ripe early, has high sugars, and is in the jammy, Zinfandel-like vein.

"As a new producer of Barbera, I'm trying to grapple with a style and direction based on multiple sourcing and blending. Greg's style for his own Boeger brand may be very forward and ripe. That may be what he shoots for. For me, I have to figure out what I can achieve, based on more diverse sourcing."

Doesn't a vineyard dictate style? "It does," Boeger remarks. "But there's variability within a large vineyard. "With the grapes that I sell, I usually take the first choice — the grapes at the

New-age vision for Barbera d'Asti

BY Eleanor & Ray Heald • Contributing Editors

Italy's Piedmont is the home of Barbera, long considered the red wine to drink while waiting for Barbaresco and Barolo to mature. Today, there is a new appreciation for the variety. Barbera has become the region's "hot" wine with a new evolving style.

Despite these New Age visions, producers in the Piedmont are proud of the traditions of their locales, such as Asti or Alba, and include these place names on their Barbera labels.

In July 1997, five high-profile Piedmont producers of Barbera d'Asti — Braida-Giacomo Bologna, Coppo, Michele Chiarlo, Prunotto, and Vietti plus Distilleria Berta — broke with the Italian winemaking tradition that favors production of wines from a single vineyard. They formed a group called Hastae and, together, produced a wine from the 1997 vintage that they named "Quorum."

The wine epitomizes the new thinking of these producers about how to grow and vinify a 21st century style Barbera. They seem to believe, as California producers do, that the best Barbera is produced from multiple sites.

According to the traditional Italian view point, Asti winegrowers, though all operating in the same locale, are competitors. Yet, they have so much in common — love of Asti's history, art, culture, villages, castles, farmhouses, cuisine, and the Monferrato hills that are home to their vineyards.

In a show of unity and singleness of vision, they ignored tradition and joined together to create the "mother of all Barberas" from one Asti vineyard owned by each producer.

Each producer chose one Barbera vineyard in his estate and cared for it in a near maniacal manner, reducing yields to 35hl/ha (2.33 tons per acre). All five hillside vineyards share south-southwest exposure, marly-calcareous soil, and Guyot vine training (5,000 vines/ha on average).

In the cellars, alcoholic fermentation was uninoculated, and there was a 15% bleeding of the must and numerous pumpovers and punch downs. Total skin contact was 15 days. The first vintage spent 10 months in new French oak *barriques* (Tronçais forest) followed by 12 months bottle ageing before release. The bottled wine, released in the U.S. in April 2000, has 13.7% alcohol with 0.60 TA, and 3.6 pH.

Quorum is not a one-time notion. The Hastae group plans to bottle those vintages when Barbera has superior quality.

Quorum attracted the participation of one of Italy's leading winemakers Riccardo Cotarella, winemaker/proprietor of Azienda Vinicola Falesco, S.r.l., in Umbria.

Beginning with the 1997 vintage, Cotarella took control of Quorum production. At his disposal are the vineyards of the Hastae producers, and in the future, the group may acquire new vineyards for continued production. ■

top of the hill that ripen first. Grapes are planted down the slopes, so ripening occurs over a period of 30 days. There are a number of different shots at maturity and flavors, offering a style or style complement from my grapes.

"La Famiglia de Robert Mondavi gets some, Jim Moore gets some, and I'll take, perhaps, the last blocks to ripen. That way, I believe, we all obtain grapes for a consistently-styled wine year to year, depending, of course, on vintage variations.

"Because Barbera is so sensitive to climate and site, I know we all agree that the best wine is made from several sources and multiple pickings."

Sonia Rued (Seghesio Family Vineyards, Healdsburg, CA) agrees. At Seghesio, Barbera ripens at different times due to low spots. "If you're going to grow it, be prepared to harvest block by block for optimal maturity," she emphasizes.

Boeger explains that, on deeper soils, Barbera is more vegetative; vines are bigger and they'll set heavier. Therefore, crop load from such a source is one variable that dictates potential wine style.

In addition, swails in a vineyard have deeper soils and tend to be cooler. Grapes in those areas will ripen last. Vines on hilltops, where soils are shallower, stress more and, with a lighter crop, ripen earlier.

"In the Piedmont, the best Barbera and other reds are grown on low-fertility slopes," notes Boeger.

Vintages also dictate style. Some vintages need to be bottled early, and others benefit from longer barrel time and/or bottle ageing before release.

High acid, low pH

For a riper style, Graziano likes to pick all three of his vineyard sources, which yield 3 to 5 TPA, at 25° Brix with a pH around 3.0 and TA over 1.0. "Mendocino has a shorter growing season and pH is quite low; TAs are higher than other regions in California," he explains.

Since 1994, Seghesio has sourced much of its Barbera from a Redwood Valley grower in Mendocino County. "Since it's a cooler site, ripening is slower," Rued remarks. "We pick at about 25° Brix, 1.0 TA, and 3.1 pH. Malic acid levels are also very high, yet after malolactic fermentation (MLF), pH rises to a more acceptable 3.4."

Graziano has not seen such a large pH shift after MLF from his Mendocino County vineyards except in the 1998 vintage.

Moore suggests a simple formula: TA minus malic acid divided by two should equal the TA of the finished wine. "For whatever reason, Barbera always goes beyond this," he emphasizes. "If at harvest, total acid is less than 10 grams/L (about 9.0 would be good), of which 4.0 or 4.5 g/L are malic acid, MLF would cause a 2.5 g/L malic reduction to a TA of 10 - (4/2) = 8.0. Barbera might be as low as 7.0 g/L."

In winter, Moore inoculates for MLF with good success. In 1997 and 1998, he used Snip & Pour (Chris Hanson Laboratory) and found MLF slow to complete. He suggests it is not the best inoculum for a high alcohol, high TA, high malic acid wine like Barbera when stored in a very cool cellar.

Pyle seeks to bottle Barbera with acid numbers of 5.0 to 5.6 TA and 3.5 pH, keeping typicity of the variety intact, without allowing the acid to get out of balance.

"Due to the naturally higher acidity of Barbera, we tend to emphasize the need to pair these wines with food for ultimate enjoyment," Pyle notes. "But we've not mastered a way to regularly showcase these wines with food. We often find ourselves talking about the food-friendly nature of the wine without even a crumb in sight."

Graziano's Barbera MLF is spontaneous in the spring and summer months, and he maintains that's why he does not see a dramatic shift in pH.

"With a high acid, high malic acid varietal, I'd rather have more assurance that MLF is going to complete," Moore adds. "Inoculation for MLF gives me confidence."

Other factors

Graziano suggests avoiding extensive shoot removal before mid-June, especially if the vineyard is not trellised. Barbera is very susceptible to wind damage. Shoots break easily. If only three or four shoots are left on a spur, wind gusts can remove half of them.

"If vines are suckered before mid-June," Sobon adds, "they'll throw twice as many laterals, and the excess foliage problem will be even greater. Post-bloom is the best suckering time for Barbera."

St. George, 5C, 3309, and 110R are the most common rootstocks for Barbera. Graziano finds that St. George (usually the oldest vines) yields fruit with higher acid, lower pH, and lower sugar. He notes that his older clonal selection is on 5C.

In areas lacking water, St. George is good because it is drought-tolerant, while 5C is shallow rooted. Graziano believes that, on St. George, any clonal selection has looser bunches because of a tendency toward poorer set.

Newer clonal selections, such as UCD Clone 4, have been heat-treated. Older clones are assumed to be Sebastiani clonal selections (which are called the Monteviña clone in Amador County). Older clones have smaller clusters and bigger berries.

When comparing a newer clonal planting to an older one, Sobon observes that the newer planting on VSP produces a wall of fruit that, if left hanging, would yield 10 TPA. At least half of this potential crop must be dropped to achieve flavor ripeness and decent acid levels.

"Dropping crop with Barbera is similar to what is required with Sangiovese," adds Sobon. "If crop is dropped too early, the end result is big berries on remaining bunches. Older, non-heat-treated, slightly virused clones seem to be self-regulating. The vine won't set a lot of crop unless it is pruned to around 15 to 20 spurs per vine or kicker canes are left.

"Yet, I don't want to be making broad generalizations, since Barbera's habits are very site specific. I do believe, however, that it's better to have too many bunches and be forced to drop some, than not to have a sufficient crop to balance the vine."

Di Giulio reinforces Sobon: "There's no single answer. Not only is each Barbera vineyard different, it's different every year."

One viticultural quirk of Barbera is that it is susceptible to downy mildew, which is rarely found anywhere in

California except in Barbera vineyards. In La Niña years with a long wet spring, downy mildew develops in low-lying blocks.

Location

Ritchie Vineyard, the source of Boeger's Barbera, is essentially a terrain of slopes and hills with low fertility considered ideal for Barbera.

The *PWV* panel did not include a producer from California's south-central coast, but Moore says, of all the Cal-Ital varieties, he considers Barbera most adaptable to that region. He describes Barbera from Bien Nacido Vineyard in the Santa Maria AVA, for example, as "dramatic."

Rued finds Mendocino County's benchland soils excellent for Barbera, because it is possible to dry farm the variety without vines defoliating or shutting down.

Water management

Graziano prefers 5C rootstock, because it responds well to water management techniques regulating vine growth. This is especially true in hillside heavy clay soils. He has drip-irrigated vineyards up to a week before harvest to keep photosynthetic activity going as long as possible.

Boeger's irrigation is overhead. He, too, irrigates Barbera as often as vines appear to need it. As harvest approaches, he waters to a soil depth of 1.5 feet.

Moore emphasizes that irrigation is not a bad practice. "If we look at Italian origins of Barbera, rain there naturally irrigates it during the normal growing season."

Sobon dry farms all varieties in Amador, except Syrah and Barbera, because those vines defoliate and shut down completely in the mid-summer heat if they are dry-farmed.

Harvest parameters

The winemakers unanimously agree on the following descending order of harvest parameter importance: visual assessment of vines and bunches and grape flavor; seed maturity with the appearance and texture of Grape Nuts cereal and seeds loose from the flesh; pH; TA; malic acid at whatever level nature gives; and finally, sugar.

"Analytical data is secondary to flavor," maintains DiGiulio. "That's lack of greenness with fully developed fruit characters as opposed to an herbaceous or tomato quality. To be ready to pick, the fruit must turn the corner from being somewhat vegetative to being fully fruit-driven. Barbera can be a very herbal varietal. That disappears when fruit is mature."

Boeger cautions: "Hopefully, we've not given the impression that, with Barbera, pH doesn't rise and TA doesn't drop. They do, but slowly and at the tail end of the season (generally October, but picking has been as late as mid-November). TA and pH changes are a big clue that picking time is close."

From destemmer to bottle

On average, berry rupture is 75% to 100% with destemming and crushing. Whole cluster fermentation with attendant stems does not suit this variety.

If color depth or concentration are concerns, about a 10% bleed after one day in the fermentor is typical.

Preferred yeast includes 71B, 2056, Assmanshausen, Lalvin BM45, Prise de Mousse, D254 (considered most alcohol-tolerant), Brunello, L2226, and combinations of these cultures, though some winemakers do not inoculate. DiGiulio believes in totally uninoculated fermentations.

Cap management techniques are based on cellar philosophies, individual preferences, and type and size of fermentors available. They include punchdown, pumpover, and sprinkling. Length of time varies, but an average is twice daily for 5 to 10 minutes. Peak juice fermentation temperature averages 85° to 90° F.

Some of the winemakers prefer to press at dryness, while others allow skin contact up to 21 days. This is also highly variable depending on the vintage.

Wine is transferred to barrel after pressing and before completion of MLF at La Famiglia, Monte Volpe, Pepi, and Shenandoah. Wine is transferred to barrel after pressing and inoculated for MLF at L'Uvaggio di Giacomo. Boeger transfers after MLF completes. Seghesio barrels wine after primary fermentation.

Choice of oak and barrel size (puncheon, cask, or 60-gallon) is related to desired style. La Famiglia, L'Uvaggio (where Oregon oak is also part of the barrel mix), and Seghesio use French cooperage. Medium-plus toast French oak is used at Pepi. American oak is preferred at Boeger (with about 25% French oak innerstaves) and Shenandoah. Monte Volpe uses a mix of French and American oak.

Age of oak ranges from 45% new to cooperage three to 10 years old. Independent of oak type, length of time in barrel averages nine to 10 months. Pepi puts wine in 30% new barrels for the first three to four months and all one- and two-year old barrels for the next five to six months.

Frequency and number of rackings are also based on winemakers' preferred cellar techniques. Most do at least one early racking when wine is transferred to barrel before MLF completes. Shenandoah racks with aeration, and the first of three Seghesio rackings is with aeration.

When a blending variety is chosen, Moore likes Nebbiolo for added structure and tannin boost. Boeger prefers Zinfandel, but also suggests Charbono, which are also Pyle's choices. Graziano blends in Dolcetto. Pepi and Seghesio bottle 100% varietal wine.

Eye to the future

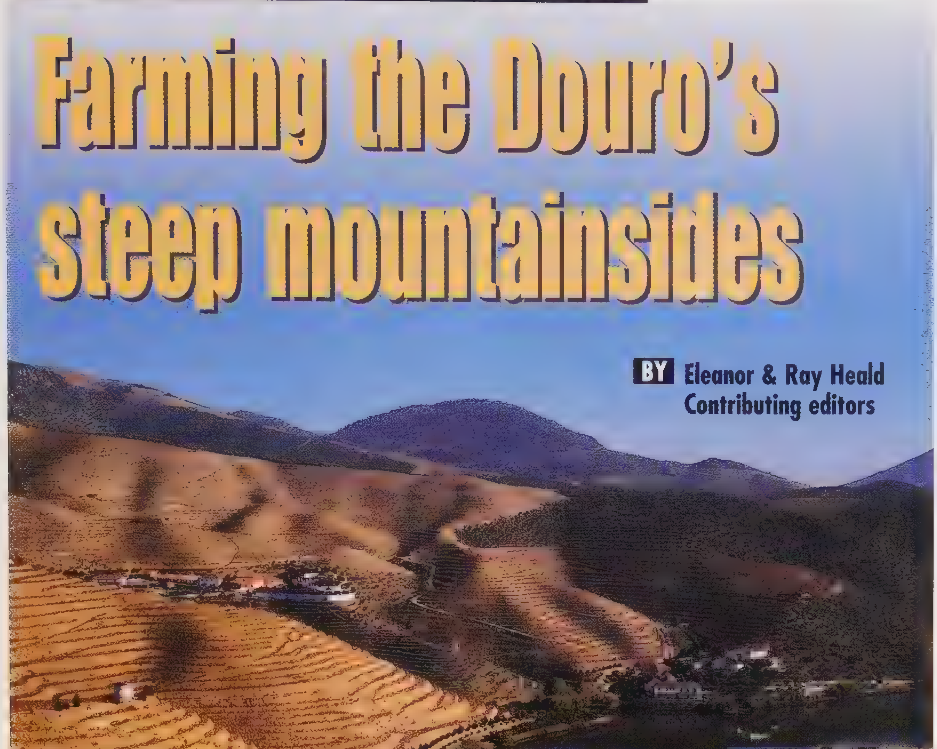
Looking at the broad range of preferences of just these few California producers, it's clear that Barbera is an adaptable variety that can be manipulated in the vineyard and easily enhanced in the cellar, especially when blended from multiple sources.

California winemakers are just beginning to explore Barbera's potential. With increased emphasis on the variety in Italy's Piedmont also, the opportunity for sharing information about the results of ongoing experimentation with Barbera should soon bring even greater achievements in wine quality for this variety. ■

PWV thanks Pepi Winery for hosting the discussion/tasting.

Farming the Douro's steep mountainsides

BY Eleanor & Ray Heald
Contributing editors



Flowing through Spain and Portugal, the River Douro (translated river of gold) eventually reaches the Atlantic Ocean at the Portuguese city of Oporto, from which Port takes its name. The river has carved a deep divide through the granite mountains of northern Portugal. Steep mountainsides flanking the river make the best vineyard sites for Port wine grapes, and here, farming the steep takes on new meaning.

Since Roman times, grapes for Port have been grown on the less hilly and easier-to-farm Lower Douro hillsides (closer to the Atlantic Ocean), and these hillsides produced the first Port wines shipped to England. In the 18th century, the Port trade saw rapid growth, which attracted settlers who began planting some of the steep granite hillsides of the Upper Douro, further to the east.

Many of the steepest sites, some with a 50% gradient and steeper, were not surrendered to vines until recently, and earlier plantings have been transformed into more productive sites by recent replantings.

All are not equal

Instituto do Vinho do Porto (IVP) is the controlling body of the Port industry. Established in the 1930s, the organization protects the quality of Port by deciding on the quantity to be made each year, based on the quantity of stocks available and the size of the market.

Miguel Côrte-Real

After IVP's establishment, an exhaustive eight-year survey of the vineyards in the demarcated area was undertaken. It resulted in a grading system for Douro vineyards, from A (most distinguished) to F according to criteria prioritized in this order:

- geographic location
- soil
- location in relation to climatic influences
- elevation and qualities of grapes grown at that elevation
- yields
- gradients
- upkeep and maintenance
- age of vines

Group-A vineyards can make the largest quantity of Port, up to 3,100 liters per hectare. B through E grade can make lesser amounts, while F-Grade vineyards can only produce table wine. Also, by law, Port cannot be made from vines planted higher than 500 meters (1,625 feet) above sea level.

More recently, a plan financed by the World Bank encouraged farmers to further improve vineyard quality. A grower, owning vineyards classified A or B, could apply for a seven-year interest-free loan to plant or replant up to 10 ha (25 acres) per vineyard. Only the highest-quality grape varieties could be used (discussed under subhead "Clonal selections and varietals").

Under this plan, nearly 2,500 ha (6,200 acres) of vineyards — abandoned after phylloxera infestation over 100 years ago — were replanted, thereby increasing the percentage of vineyards classified A and B.

Climate

Climate along the Douro is one of extremes, and it is closely linked to location and altitude. All sites experience severe frosts in winter and long, hot summers with temperatures in excess of 100°F. Within the 120-mile river stretch in Portugal, rainfall varies greatly among microclimates.

Weather patterns are altered by the mountains. For vineyards between 200 and 300 meters (650 to 975 feet) elevation, the mountains are high enough to reduce the ocean's influence on weather, and ideal climatic conditions exist year-round.

Soil profile

There is no wine that can truly be labeled Port that has not drunk the beauty of the Douro through its roots and been seasoned by the region's unique rocky, schist soil.

Mountainside vines grow in a topsoil of layered rock-like slate called schist. While so hard it often requires dynamiting before planting can begin, schist is mineral rich with good water retention.

Some mountainside vineyards still have old-style, extremely steep terraces supported by dry stone walls. These traditional terraces, each with a single vine row, are impossible to cultivate mechanically. Hand labor is required.

This system is disappearing, however, and being replaced with modern wider terraces, called *patamares*. Bulldozed out of the hillside, they do not require support walls, so modern, mechanized farming is possible.

Some producers prefer not to terrace the slopes, and they plant vines vertically on the hillside rather than horizontally. Miguel Côrte-Real, commercial and viticultural director for Cockburn Smithes & Co., S.A., and Martinez Gassiot, have experimented for over 20 years with vertical planting at some vineyards, but Côrte-Real prefers terracing the steepest sites to help minimize soil erosion.

A native of Oporto, Côrte-Real began his viticultural education in Portugal, then went to Montpellier, France, to specialize in viticulture. He then did clonal research studies at ENTAV in Montpellier and studied oenology at Charles Sturt University in Australia. He began working at Cockburn's in 1978 at age 24.

Cockburn's properties include examples of traditional terrace walls, in some sites one meter thick, which support two vine rows. Alongside these, Côrte-Real has constructed *patamares*. They are particularly noticeable at Quinta dos Canais, Cockburn's crown-jewel vineyard.

Cockburn's is considered the pioneer in vineyard cultivation, has only Grade A vineyard holdings. They are located in the Upper Douro at Tua, Vilariça, Val Coelho, and Canais, and there is also a small vineyard in the Lower Douro at Santa Maria.

At Quinta do Atayde (an undulating non-terraced 750-acre vineyard) in Vilariça, Cockburn's has introduced block planting (a separation of vines by variety), which offers more effective picking, since each variety can be harvested at optimum maturity.

This innovation also brought with it the cellar advantage of keeping wine from different blocks separate during vinification, thereby making a selection of high-quality wines easier for blending.

"Consider the situation for Port when all the vines are mixed (field blend) on the same site," Côrte-Real remarks. "When such vineyards are picked, maturation is an arithmatic average of the varietals. Field blends are from an age that's past. Block planting insures the proper maturity for each variety."

Cockburn's Douro River quintas (farms) are planted on the steep. With variations from 100 meters (325 feet) above sea level at the river's edge to an optimum 300 meters (975 feet) at the highest vineyard, ripening of the same grape planted at either extreme varies enormously.

Vineyard gradient determines the number of vines per hectare. In some cases, *patamares* allow only two vine rows and at the most, three. Spacing between vines is 1 meter and between vine rows is 2 meters.

Quinta do Tua at Chousa is a traditionally-terraced vineyard. Quinta de Val Coelho is a mixture of both traditional terracing and *patamares* and some experimental vertical planting.

In 1989, Cockburn's purchased Quinta dos Canais (300 ha, half under vine), and Côrte-Real went to work making it the company's most important holding. Addition of another 20ha

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to 30ha of vines is possible with extensive dynamiting.

Canais, a 740-acre property with average 50% gradient, is on the north Douro bank; therefore, it faces south and benefits from long hours of sunlight. Another advantage is an abundant water supply, channeled around the top of the property in canals, which give the vineyard its name.

For more than a decade, Côrte-Real has experimented with improvements to rootstocks and clones at other Cockburn's quinta and at the nursery Cockburn's established. Drawing on this plant material and lessons learned through experience, he drew a vineyard blueprint for Canais and then brought in heavy equipment, creating modern terraces for the block planting system.

Rootstocks, grafting, training

No certified virus-free rootstock existed in Portugal in 1978, when Cockburn's began planting Vilariça. This prompted Côrte-Real to begin a three-year massale selection to propagate the best vines.

Vines were marked twice yearly. In spring, vines without viral symptoms were chosen for ampellographic typicity. At harvest time, they were earmarked for production qualities, based on bunch and berry size.

After the second year of massale selection, micro-vinification from the selected vines was done to judge wine quality.

Also in 1978, unhappy with the available rootstock sold in Portugal, Corte-Real sourced mother vines from France, establishing for Cockburn's the first Portuguese nursery with a virus-free rootstock production. He began developing new clonal selections of permitted varieties to produce higher quality and higher-yielding vines. Thus, Cockburn's had healthy, higher quality plant material available for Quinta dos Canais in 1989.

Cockburn's clonal research was conducted in association with the University of Vila Real in Vila Real City, and the clonal selection was done at Cockburn's Quinta do Atayde in Vilariça in conjunction with extensive soil experiments to match both the rootstock and varietal to the Canais soil profile.

Rootstock selection at Cockburn's is based on soil type. R99 and 110R (*Rupestris x Berlandieri)* are most widely used since they are less vigorous and help in the production of a higher yield than the Rupestris du Lot, that dominated the old Douro vineyards.

New planting at Canais and 90% of the vines at Vilariça were grown from rootstock that was planted, allowed to grow one year to establish, and then grafted to one of the selected Port varietals. In poor soils, lacking the possibility of irrigation, field grafting is the only way to go. Takes are between 95% and 98% successful. More expensive, pre-grafted material is much less successful.

Cockburn's uses a cordon system. The trunk is grown to a height of 35cm (nearly 14 inches) from which two cordons are trained in opposite directions.

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Three spurs per cane are left at pruning, which takes place from December to February. A spur system allows easier use of mechanization. Spraying against oidium and mildew is done between March and June.

To be included in Port production, a vine must be four years old. Grapes picked at third leaf may be used for table wine.

Selected varietals

Viticulture and vinification are the two guiding principles behind Cockburn's selection of specific grape varietals for its Port production. Chosen varieties were analyzed for disease resistance, yield, and resulting wine. The five varieties that performed best were selected for new plantings, such as Quinta dos Canais, and replantings in other Cockburn's vineyards.

- **Touriga Nacional** is a low-yielding vine with grapes of abundant color and tannin. Côrte-Real considers it the top variety for production of vintage Port. "It is our Cabernet Sauvignon," he notes. " If we ever decide to make a single-varietal Port, it will be with Touriga Nacional because it has everything — high-toned aromatics, lots of red fruits, fantastic structure, and very good tannins."

Production is small, but through improvement over the last 15 years of clonal selection, this variety has a larger yield and is now more widely planted along the Douro. Touriga Nacional grows best in stony soil and ripens midway through the harvest period.

- **Tinta Barroca** is a higher-yielding vine. Needing more water, it is grown in the lowest vineyard blocks. It is the first varietal picked and provides a well-balanced component with abundant aroma and fruit flavors without over-powering other varietals. If the growing season is cooler than normal or more humid because of rain, Tinta Barroca will have optimal potential alcohol.

- **Tinta Roriz** is a useful grape, but one more susceptible to cold, therefore less reliable in quality. It ripens midway through the harvest period. While the variety represents 30% of plantings in the Douro, when it crops high, the quality is poor. It looses tannins and structure. When crop levels are in control (approximately 3.5Kg or 7.7 lb/vine), the variety contributes to aromatic intensity. Young ruby Ports acquire a peppery spiciness from Tina Roriz.

- **Tinta Cão**, grown in smaller quantity, it is an essential part of Cockburn's Special Reserve blend. It, too, ripens midway through the harvest period and adds to overall flavor and body.

- **Touriga Francesa** is a "young" vine with only a 200-year history in the Douro. It appears to be virus-free and, as the last variety to ripen (three weeks later than Tinta Barroca planted on the same site), prefers dry soil and abundant heat. Independent of site, it exhibits uniform characteristics. It is slightly floral and adds delicacy and aromatic lift.

Côrte-Real will be conducting experiments with three other varietals — Sousão, Tinta Amarela, and Tinta da Barca — not in use in Cockburn's Port production currently. He finds Sousão interesting, not for its aroma, but for color and tannin levels.

Currently, Tinta Amarela is being grown in an area of the Douro that receives more rainfall, and it is subject to *botrytis cinerea*. He believes it could be a useful varietal in the Upper Douro with its lower rainfall.

Tinta da Barca was an important variety in the old vineyards of Quinta dos Canais. "For this reason, I believe it's important to have some of this variety there," he adds. "Ampellographically, it has characteristics between Touriga Nacional and Touriga Francesa."

Future impact

Cockburn's extensive clonal selection work has proved valuable in areas beyond its vineyards. Growers supplying wine for the Cockburn's blends receive technical advice, virus-free grafts, and rootstock from Cockburn's nursery vineyard at Tourão in the Vilariça Valley, the first nursery of its kind in Portugal.

Côrte-Real's continued improvement of viticultural practices at Cockburn's quintas, and especially at Quinta dos Canais, has improved the quality of Cockburn's Ports. Will this create more declared vintage year Cockburn's bottlings? "Probably not," Côrte-Real responds. "It has however, raised the quality bar, and we have greater expectations for what is top quality in a declared vintage year." ■

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BARBOURSVILLE VINEYARD

Gianni Zonin (L) and Luca Paschina winemaker/general manager.

An Italian Approach to Virginia Grapegrowing

BY Millie Howie

Many sites in central Virginia have a connection of some sort to the state's most illustrious citizen, Thomas Jefferson, President of the U.S. (1801–1809). At Barboursville Vineyards (Barboursville, Orange County, VA), the tie is a strong one, extending back more than 200 years to the attempts by Dr. Filippo Mazzei of Tuscany to introduce vinifera wine grapes at Monticello, Jefferson's estate.

In 1776, Mazzei's ambitious undertaking was cut short when his workers joined the Continental forces in the American Revolution, and the vineyards were trampled by horses. He returned home to Italy.

Road to success

During the celebration of the American Bicentennial in 1976, in a coincidence that would have pleased Jefferson, two young Italians, Gianni Zonin, president of Casa Vinicola Zonin S.p.A., the largest private wine company in Italy, and his wife, Silvana traveled to Virginia to visit friends. While touring Monticello, they heard that the historic 800-acre Barboursville Plantation was for sale. Once owned by Thomas Jefferson's good friend James Barbour, governor of Virginia from 1812–1814, the land still contained the ruins of the Barbour Mansion, which was designed by Jefferson.

The historic significance of the site appealed to Gianni Zonin, who also liked the idea of continuing the introduction of vinifera begun by Mazzei. The Zonin family purchased 700 acres of the land, which was being used as sheep pasture.

If Jefferson could return today, he would be pleased and dumbfounded by the rolling acres of vitis vinifera growing where sheep once roamed. He would be impressed by the ever-increasing production of fine wines in the European style he loved so well in the heart of the Monticello Appellation.

Where other wineries, through two centuries, tried and finally gave up on vitis vinifera, the Zonins persevered. Fighting Mother Nature's cold and damp, continuing technical problems, political pressures, and some say, vandalism by disgruntled neighbors who disapproved of his pioneering stance, Gianni Zonin has achieved success at Barboursville.

Zonin began extensive testing to determine which grape varieties would do well in the area and brought Gabriele Rausse, an agronomist at their family winery near Vicenza in northern Italy, to do the planting under Gianni's supervision.

First plantings

In 1977, 3,000 vinifera vines were set out in a five-acre plot of Cabernet Sauvignon, Pinot Noir, Chardonnay, and Riesling. Eighty percent of the vines did not survive the severe frosts and ravages of powdery mildew. Yet, from this meager beginning, the Zonins created the first commercial all vinifera vineyard in Virginia. By 1999, 126 acres of vineyard were in production.

Steady growth

In 1979, 500 bottles of Barboursville vinifera wine were produced in a makeshift winery housed in a converted farm building. Ten years later, production had reached 9,000 cases from 50 acres of vineyard. Total production in 1998 was 23,000 cases. The winery harvested 580 tons of grapes from the 1999 harvest to produce 29,000 cases of wine.

Construction of the winery began in 1980 and upgrading and expansion were completed in 1999. The buildings resemble a Tuscan villa, including an 8,000 sq.ft. winery, a 2,400 sq.ft. barrel ageing cellar holding 655 barrels, and 7,200 sq.ft. of warehouse space. The crush is conducted in a 3,300 sq.ft. outdoor arcade area.

Diversity of varieties

"I am experimenting with a lot of wines," says Luca Paschina, winemaker and general manager, who joined Barboursville Vineyards in 1990. Paschina graduated with a degree in enology from Institute Umberto Primo in Alba, Italy, in 1983 and began his career in the Asti Region making still and sparkling wines. He had just established a private consultancy in Piedmont and Tuscany when Gianni Zonin asked him to work the harvest in Virginia.

"I really liked the area," he says, "and after I went home and wrote my report, including some ideas of what they should be doing, they called me back. In 1990, I arrived to manage the operations."

Among the changes Paschina suggested, which are now being implemented, was a switch from the Italian "casarsa" style of trellising, which according to Paschina, required low maintenance and yielded good tonnage but resulted in limited quality.

"Now we are following the practices of viticulturists in Bordeaux and Burgundy and using vertical shoot positioning. We prune all vines to six spurs per cordon. This gives us a lower yield — averaging 2.5 tons per acre, but it is the only way to make balanced reds with good color and tannin."

Paschina counts yield by vine, not tons per acre, and holds the reds to no more than six pounds per vine and varieties such as Chardonnay to a high of eight pounds.

"It takes a few years to get to know your vines, the soil, and climate," he remarks. "I feel that the Virginia climate is very similar to the climate in Bordeaux. After you see the results for a while, you can take advantage of the best each element has to offer. Although, sometimes when you blend, you find you don't get the results you expected. In those instances, the wine is still good, but not up to your standards, so you sell in bulk."

Vineyard changes

Two years ago, Fernando Franco, who had 14 years experience in viticulture in Virginia, primarily with Prince Michel, joined the winery. At about the same time, Paschina brought in Stefano Salvini, an Italian winemaker, as his assistant.

This team has embarked on a program of converting vineyards, introducing high technology, and hiring good people. "We do little advertising or sales promotion," Paschina comments. "The only way for us to gain recognition is to make good wines and travel and do presentations to the press."

There are 19 vinifera varietals growing in the estate vineyards. Major varieties are Cabernet Sauvignon (20 acres), Cabernet Franc (19 acres), Chardonnay (15 acres), and Pinot Noir (12 acres). Recent plantings include Nebbiolo, Sangiovese, Viognier, and extended plantings of Merlot, Cabernet Franc, and Cabernet Sauvignon.

"Our Cabernet Franc is doing best," remarks Paschina. "There is less variation in yield and quality vintage to vintage. Next are Pinot Grigio and Chardonnay and then Merlot, which has its ups and downs. We produce Orange Muscat, Gewürztraminer, and Muscat Canelli, and find that the aromatic varieties do very well in Virginia.

"In 1996, we planted two acres of Nebbiolo, and we will add five more in 2000, along with four of Petit Verdot for blending into the reds."

The original spacing in the vineyard planted in 1976 was 10 feet between rows and six feet between vines. Now the winery has moved to higher density planting. All the vineyard planted since 1995 has been on a spacing of 10x3, all with a vertical trellis system. Trellises on the Nebbiolo are 12 inches higher than on other varieties, since Nebbiolo grows tall, and the higher wire provides more leaf surface. Rows are oriented north to south in all vineyards.

There are two acres each of Sangiovese, Riesling, and Gewürztraminer planted in 1997, and Franco is pleased that they had 100% take on three acres of Pinot Grigio planted the first week of May 1999. "We will be getting about an 80% crop in 2000

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from 11 acres of Chardonnay, which we planted in 1998 and trained to be spur-pruned," he adds.

Over the next three years, Barboursville will continue its vineyard planting of three new acres. The team is also replanting some blocks to replace older clones. "Some of the clones available when the vineyard was first installed were not as good as those currently available," Paschina explains.

Vineyard practices and problems

"In these vineyards in the foothills of the Blue Ridge Mountains," Franco notes, "location can be very important." The elevation varies from 720 feet at the highest point to 500 to 600 feet at the lowest point around the winery buildings. The winter temperatures can show a variation of five to 10 degrees between these two locations.

The soil is red clay. There are good nutrients in the organic materials in the soil, and it has good water-holding capacity. Because the soil supports vines of moderate to high vigor, the winery avoids using a high vigor rootstock when planting and re-planting.

The climate is relatively moderate, according to Franco, though winter temperatures sometimes drop to 0°F in some locations, so site selection is very important. Summer hot spells reach 100°F to 102°F and humidity ranges from 50% to 100%. The first two weeks of August 1999, the heat index rose to 120°F. From April 1 to October 31, the vineyards average 3,952 heat units.

"Because we seek to hold growth to a moderate level, we have used SO4 rootstock. Only the Cabernet Sauvignon tends to get too vigorous with SO4. Cabernet Sauvignon survives very well in our winters," explains Franco.

Vineyard crews go through the vineyard doing shoot-positioning three times, leaving 18 leaves per shoot, on shoots 3.0- to 3.5-feet long. Mechanical hedging of the vines is normally done in early July.

"Because we use vertical shoot positioning, we hedge only to remove excess growth on the top. Depending on the variety and growing season, we may hedge a second time, but this is rare," says Paschina.

"Problems, other than temperature drops are few," Franco remarks. "We do have powdery and downy mildews, which are controlled by sulfur applications. We have some occurrences of black rot and phomopsis, but we maintain a strong preventative program, with very little use of chemicals. The greatest problems are birds and a few deer, and, worst of all, raccoons. Raccoons love grapes!

"Cover crops are very important in the Virginia climate. Without the cover, when it rains we would not be able to get into the vineyards. We use a native fescue grass that tolerates vineyard traffic."

There are no irrigation lines in the vineyards; wind machines provide protection from spring frosts. "It would be nice to have irrigation," Franco admits, "but for the first year or two of the vine's life, I think it is important for the vine to be stressed, to build a strong root system." However, 1999 was the third consecutive drought year in Virginia, and should conditions become serious, Franco would have to irrigate, giving each vine a gallon of water from a 500-gallon tank.

"You really have to treat the vines like people," Franco says. "You have to give them a lot of attention and monitor them constantly. Any little mistake we make in the vineyard is going to show up in the bottle."

Harvest and winery functions

After all the pre-harvest sugar testing has been done, Paschina and Franco make a final decision by tasting grapes. Harvest usually begins the third week of August with Pinot Noir and Chardonnay, picked at 19° to 20° Brix for the Barboursville sparkling wine.

Currently, crews hired through labor brokers pick the fruit by hand. "We are looking into purchasing a harvester as insurance if labor becomes difficult to secure," says Paschina. "The technology of machine harvest-

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ing is getting quite good. Fruit comes in clean with little MOG, and the berries are intact."

White grapes arrive at the winery in 35-pound baskets and go directly to the destemmer/crusher. "We do no whole-cluster pressing," Paschina says. The aromatics (Gewürztraminer, Muscat, Johannisberg Riesling, and Malvasia) and some Chardonnay are allowed six to 12 hours skin contact at 67°F in stainless steel.

The winery has 21 temperature-controlled, stainless steel, jacketed tanks and 28 non-jacketed tanks. Four of these are pressurized for making Charmat-process sparkling wine. They can also be used as holding tanks during bottling. The bottling line can fill 2,400 bottles per hour. Wire hoods for the sparkling wine are applied by hand.

"Some of the Gewürztraminer, Chardonnay Reserve, Viognier, and Malvasia are barrel-fermented in four or five-year-old, neutral barrels. I feel this gives me a more integrated wine. These wines are released the spring or summer following harvest," states Paschina.

Barboursville Winery has added a new 14-ton bladder press from Italy to augment a six-ton press. This equipment is used for all the grapes, which also go through the destemmer/crusher.

White wines ferment at 65° to 68°F in temperature-controlled tanks. There are three rotary fermentors for fermenting red grapes held at 90°F for the first six to seven days to extract the tannins quickly and preserve the character of the grapes. The must is then allowed to cool naturally to 80°F and allowed to macerate for several days longer. "We do a couple of rotations each day," says Paschina, "and we also open the door with the fermentor in the upright position and do two pump-overs per day to give the fermenting wines as much air as possible and to keep the cap moist."

All wines are fermented to dryness, and the Sangiovese and Barbera are left on the skins for three to four days of extended maceration. Cabernet Franc, Cabernet Sauvignon, Merlot, Nebbiolo, and Pinot Noir remain on the skins for 10 to 15 days to extract as much tannin as possible. "This is, of course, the practice in a perfect harvest," explains Paschina. "If the fruit comes in less ripe, the period is shortened."

Once fermentation is complete, the juice is drained from the skins, which are moved to the press. "We inflate the bladder only once to 0.8 bar. That way, we extract only about half the wine trapped in the skins, and usually end up dumping very wet pomace," continues Paschina.

"The wine coming out of the press is low in color with high pH and extremely high tannin. We hold it separate and consider it a valuable part of the blending. It is like a 'spice' you would add in cooking. It's a lot of work, and it's wasteful, but you have to make sacrifices for quality."

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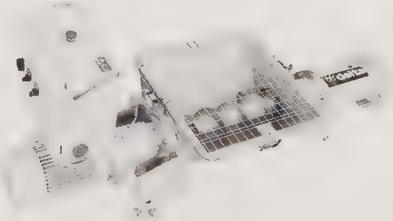

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Franco, Paschina, and Salvini are all involved in tasting and blending. Other staff members are invited to participate, and Paschina particularly encourages the retail sales people to take part to improve their understanding of how wines develop. However, the final decision on the blend is Paschina's.

"Most of the time, I have the concept of the blend in my head, because I am familiar with the clones and the sites where the grapes grow. In a way, blending is like cooking. A chef doesn't have to taste every ingredient over and over, but he does taste for the blend of flavors. Blending is not guessing. I know what the interaction will be. With experience, you can determine in your head what will be good."

Ageing

The Merlot receives three months in barrel, with the Reserves remaining in barrel for two years. A mix of French, American oak (primarily from Lebanon, KY), and some Hungarian barrels is used. Franco prefers medium toasting, because he feels it gives the winemaker better control of the oak influence. He also feels a mix of new and older barrels allows for more blending capabilities.

Barboursville Vineyards bottles no generic red, although Paschina says he has been thinking about it. "Our Reserve reds spend 10 to 18 months in barrel." he remarks. "Most of the time, even for a very good red, 10 months is enough. Then they are allowed to settle for six months in stainless steel until clear. We do not filter before bottling, and I almost never fine my wines. In bad vintages, I may have to use some egg whites, but we still do little fining.

"The reds receive two to three months bottle age. I do not think it is bad for the wine to go to market early after bottling, although it will not express its full potential."

Barboursville wines

There are generally 18 to 21 wines released each year by Barboursville Vineyards: typically, eight white, 10 red, three dessert wines, and the Barboursville Brut. Older vintages of the Reserve wines are available for purchase in the tasting room.

Octagon, which sells for $25 per bottle, is the top-of-the-line red, a Meritage-style blend of the best barrels of Cabernet Franc, Cabernet Sauvignon, and Merlot from two vintages. There have only been two bottlings of Octagon so far. The first, in 1993, was a blend of the 1991 and 1993 vintages; the second was 1995 and 1997, and the next, a 1997 and 1998 blend will be released in spring 2000.

The label for Octagon bottling features a drawing of the original floor plans of Governor Barbour's mansion, which was destroyed by fire Christmas day in 1884 and never rebuilt. The ruins of the mansion, now honored as a registered Virginia historic landmark, are featured illustrations on all labels, except the Phileo dessert wine ($15.99), which has a vineyard scene.

Phileo is the Greek word for love of friends and special things. According to Paschina, Phileo is a blend of Muscat Canelli, for powerful fragrance, Orange Muscat for floral complexity, Traminer Aromatico (accepted Italian designation for Gewürztraminer) for lasting aftertaste, Riesling for citrus edge, and Malvasia for elegance. It is light and sweet, with 8% residual sugar and 12% alcohol.

Malvaxia Reserve, a Late Harvest Malvasia bearing the Old World spelling of the grape name, is fermented and aged in white oak for five months and bottled with 5% residual sugar.

All of the Barboursville Vineyards wines have won multiple awards at national and regional competitions. In 1999, the 1997 Cabernet Franc was awarded the Virginia Governor's Cup.

Visitor facility and events

The recently enlarged and renovated visitors' center at Barboursville Vineyards, includes the new Ristorante Palladio, a casually elegant dining room overlooking the vineyards and the ruins. One of only two winery restaurants in Virginia (the first at Prince Michel Vineyard in Leon), Palladio is named after the Italian architect, Andrea Palladio, who influenced Thomas Jefferson's architectural achievements. The restaurant serves lunch, Wednesday through Sunday, and one 7pm dinner seating on Friday and Saturday.

Chef John Marshall was trained in the preparation of traditional northern Italian foods in Italy and served as an apprentice at Vittorio Restaurant in New York City. The menu is changed weekly reflecting his background and training. Suggestions of Barboursville wines and Italian varietals, produced on the Zonin estate in Italy, are keyed to each item, from appetizer to dessert, on the menu.

Each year, a series of banquets featuring outstanding chefs from East Coast restaurants is offered from May through November. Several of the afternoon dining events also feature performances by the Opera Society of Charlottesville.

Two public barrel-tasting weekends, one in the spring and the second in the fall, are open to the public. Musical entertainment and hayrides are part of the celebrations, which allow sampling of library wines and tastes of current vintages. In August, the winery sponsors dramatic presentations of "Shakespeare in the Ruins."

A large gift shop (1,200 sq.ft.), with an emphasis on Virginia-produced articles, adjoins a large tasting room (600 sq. ft.). They are open Monday through Saturday from 10:00 am till 5:00 pm, and Sundays from 11:00 am till 5:00 pm. A $3 tasting fee allows tastes of 12 wines and includes a free souvenir glass. Tours of the winery and the ruins are offered every half-hour Saturdays and Sundays.

Virginia's place on the wine scene

"The Virginia wine industry is very young, and we cannot be competitive on the basis of volume sales," concedes Paschina, "But I see the future for Virginia wines as an expression of highest quality. We have distributors in Washington, D.C., New York, Boston, and Chicago, and about 80% of the winery's total sales are to restaurants. Our next step will be to move into wine shops."

To enhance its marketing efforts, Barboursville Vineyards produces a newsletter and attracts 35,000 to 38,000 visitors to the winery each year through special events. The winery's well-maintained web site is found at *www.barboursvillewine.com.* ■

Grape seed tannins: impact on red wine

BY Dr. James Kennedy
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Winemakers and wine writers alike describe tannins in red wine using qualitative terms,[19] (Table 1). It is readily apparent from periodicals devoted to wine appreciation that tannin quality is an important attribute in red wine quality.

Table I
Descriptive terms given to red wine astringency

Terms generally recognized as positive:
ripe[1], soft, round, velvety, silky, supple

Terms generally recognized as negative:
unripe[1], hard, green, harsh, aggressive

notes: [1] Qualitative terms related directly to fruit maturity.

It is important therefore to understand the factors affecting tannin quality so that better wines can be made. It is recognized that enological practices, such as extended maceration and ageing (cooperage, oxygen exposure, and time), can influence the tannin quality in red wine. It is also recognized that tannin concentration and quality are initially determined in the vineyard, with seed number and fruit maturity playing leading roles.[10, 15]

While a definitive explanation for tannin quality does not exist, speculations typically fall into one of the following two categories:

The *concentration (i.e.* the "quantity effect"): tannins are described (positively or negatively) based on their ***concentration*** relative to other wine components *(i.e.* acidity, sugars, flavor components, and alcohol).

The *structure (i.e.* the "quality effect"): tannins are described (positively or negatively) based on their ***structure***, which changes during fruit ripening.

Presented with a problematic wine, and given these explanations, two very different approaches would be taken by a winemaker to improve the tannin quality. For the wine's concentration, adjusting the tannin levels in the wine relative to other wine components would result in an improvement in quality.

Conversely, for the wine's structure, a modification in tannin structure would be required for the same improvement in quality. Since definitive studies on grape tannin structure variability during fruit ripening have not been done, it is not at all clear whether tannin structure even changes.

Since grape seed tannins normally make up a significant proportion of the tannins found in red wine,[23] observed modifications in their structure during fruit ripening could lead to a testable theory for red wine tannin quality.

Initial research efforts toward an understanding of how tannin structure could affect the quality of extracted tannin in red wine have focused on grape seed tannins. This report is a summary of the research conducted on grape seed tannins and subsequent development of testable hypotheses that could explain differences in red wine tannin quality.

Grape seed tannin structure, changes during fruit ripening

Grape seed tannins are a complex group of compounds based on the flavonoid ring system.[1] While most flavonoid compounds have this three-ring system in common, the complexity of the tannins arises from their polymeric nature, composed of different flavan-3-ol subunits linked together (Figure 1).

Individual tannin molecules can vary in length from oligomers (containing two subunits) to polymers (reportedly containing over 19 subunits). Based on the most prevalent linkage between subunits, grape seed tannins are predicted to adopt a helical three dimensional structure with the B-ring radiating around the perimeter of the central helical core.[2, 8, 5, 11]

From microscopic and sensory examinations of developing grape berries, tannins are synthesized beginning at a very early stage of development (essentially from anthesis).[9] Based on our knowledge of the development of tannins in the peach, it is likely that tannins increase steadily during Stage I and the early part of Stage II of berry development.[22]

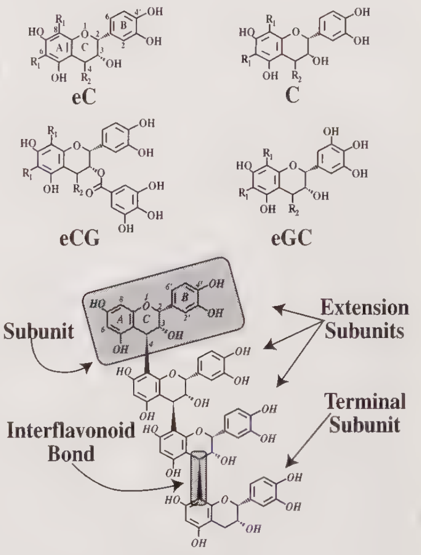

Figure 1

Extractability of seed tannins, from bloom through harvest, probably increases to a maximum during, or just prior to, Stage II of berry development, and thereafter declines (Figure 2). The increases in tannin extractability during Stage I and II of berry development would be due to the biosynthesis of tannins. The decreases in extractability during Stage III (fruit ripening) however, suggest that a developmental change has occurred.

From rigorous examinations of grape seeds and their tannin structure during fruit ripening, it is clear that there are indeed changes that the seed goes through, and furthermore, that these changes affect the tannin structure.[13] The most obvious visual change in the seed is a change in the seed coat color,[3] from a bright green to a dark brown. From the development of other plant seed coats, these changes are consistent with the final oxidation of the seed coat.[16, 24]

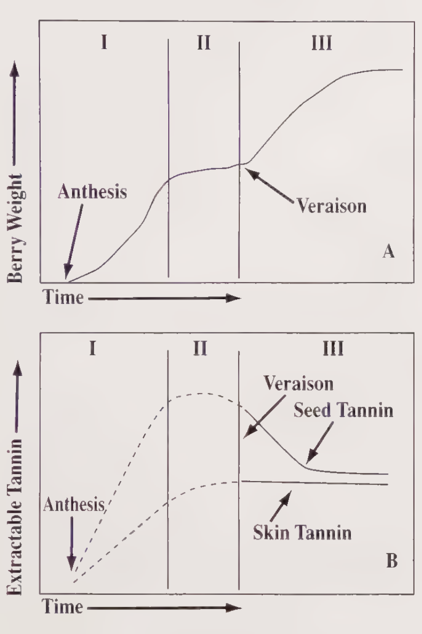

Figure 2

The changes in tannin structure are also consistent with oxidation. These changes include:

- decreasing extractability, with the decline in extraction consistent with an oxidation model,
- apparent increase in the average tannin length when analyzed intact and a decrease in length when analyzed after degradation,[12]
- upon degradative analysis, there is a decreasing conversion of tannins to known degradation products.

In order to understand how these changes in tannin structure during fruit ripening could play a role in the quality of red wine astringency, it is necessary to review the sensory properties of the tannins, and the way in which the tannins elicit their response.

Sensory Properties of Tannins

Mouth feel is the tactile perception of a wine in the mouth and is the sum of all components that can elicit a tactile perception including polysaccharides, ethanol, glycerin, as well as the tannins.

Tannins extracted from grapes during red wine production have two sensory properties associated with them: bitterness and astringency.[18, 21] In addition to sweetness, sourness, and saltiness, bitterness is a taste perception, and as such, there are taste receptors specific for bitterness.[19] For bitterness, these receptors tend to be concentrated on the back of the tongue.

Of the tannins extracted from grapes during red wine production, the low molecular weight molecules are predominantly bitter, whereas the higher molecular weight tannins are predominantly astringent.

Astringency is the feeling of dryness and roughness in the mouth. In red wine, this perceived dryness is associated with intensity and duration (Figure 3). The primary reaction responsible for this dryness is believed to be the precipitation of lubricating salivary proteins by tannins.[1] Because of their complimentary structure, salivary proteins and tannins are uniquely suited for complex formation.[4, 8, 9, 25] Presumably, the formation of a salivary protein-tannin complex inactivates the tannins before ingestion and minimizes the loss of dietary and digestive proteins.[17]

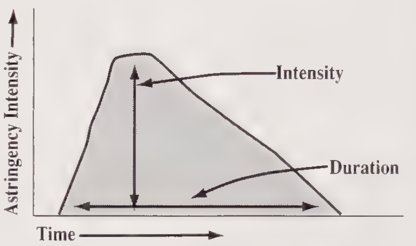

Figure 3

The complimentary structural features of the salivary proteins and the tannins are responsible for two effects

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which are expected to occur during their complexation: hydrophobic interactions and hydrogen bonding. Of these, the hydrophobic interactions are considered to be the driving force for complex formation.

Following the initial formation of a salivary protein-tannin complex from hydrophobic interactions, the complex is strengthened considerably by additional hydrogen bonding. The salivary protein-tannin complex is still soluble and requires additional aggregation to cause precipitation and subsequent astringency prerception, (Figure 4).[7] All of these processes are reversible and can have varied stoichiometries.

Tannin structure can influence protein interaction. Molecular weight, substitution pattern, and flexibility have been shown to affect the ability of tannin to interact with protein.[20] Based on the changes that the grape-based tannins undergo during fruit ripening, it is expected that their interactions with salivary proteins will become modified.

Concept of Tannin Quality

Given our current understanding of tannins, what precisely are desirable and undesirable tannins, and how could grape maturity affect their levels? From personal experience, conversations with winemaking professionals, current understanding of tannin changes during fruit ripening, and-tannin interaction with salivary proteins, three explanations for the change in tannin quality can now be given.

Theory I: Balance hypothesis

The first explanation is that changes in tannin quality have nothing to do with tannin structure at all, but are dependent on "balance" (see "concentration" above). If tannins are too high in concentration relative to other sensory components, then they overwhelm the perception of the other components in red wine and therefore are deemed hard and aggressive.

It is clear that tannins are more easily extracted from underripe grapes. Moreover, there are many biochemical processes that occur during fruit ripening, most of which lead to a reduction in perceived astringency, including a reduction in acidity, increases in sugar, soluble pectins, and flavor components.

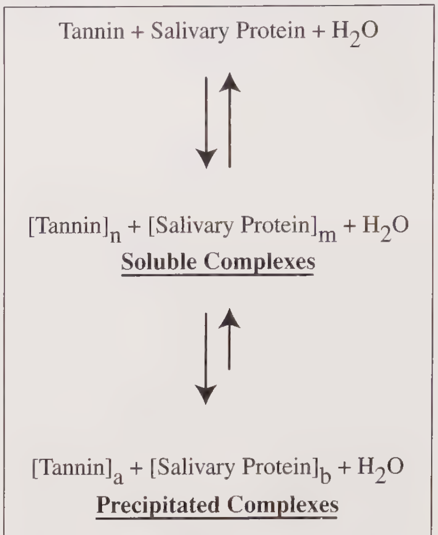
Tannin + Salivary Protein + H_2O
$[\text{Tannin}]_n$ + $[\text{Salivary Protein}]_m$ + H_2O
Soluble Complexes
$[\text{Tannin}]_a$ + $[\text{Salivary Protein}]_b$ + H_2O
Precipitated Complexes

Figure 4

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The net effect is that, with fruit ripening, the possibility of having too much perceived astringency in wine is diminished because of the increasing role that other negating factors play in wine perception, and the increased development of flavor and aroma compounds.[6] To use winemaker terminology, underripe tannins would be considered to be tannins that are excessively present, and those that are ripe are in balance with other components.

Theory II: Bitterness/Astringency hypothesis

The second explanation for tannin quality is based on changes in tannin size. During fruit ripening, the average size of the tannin extracted from grape seeds increases. Therefore, as grapes ripen, the extracted tannins should elicit less bitterness and more of an astringent response.

Now the semantics: Some winemakers, when describing the tannin transition from unripe to ripe, describe the corresponding astringency as moving from a centralized and intense response in the back of the mouth for unripe tannins (bitterness sensed in back of the mouth), to one that is more general in location for ripe tannins. Additionally, unless bitterness is exceedingly high, winemakers rarely use it as a descriptor; it is part of the perception of mouth feel.

The bitterness and astringency responses that sensory scientists consider to be separate are *not,* in the opinion of winemakers. Again, to use winemaker terminology, under-ripe tannins would be considered to be tannins that have an excess of low molecular-weight tannins (the bitterness component), and those that are ripe have less.

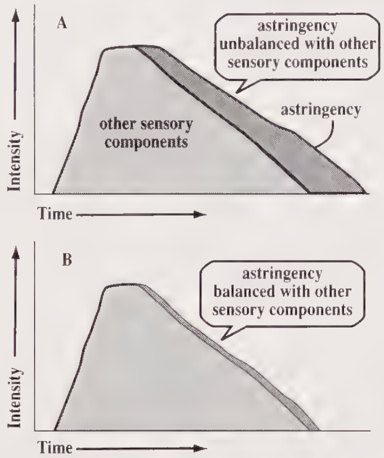

Figure 5

Theory III: Intensity/Duration hypothesis

The third explanation for tannin quality is based on structural modifications of the tannins leading to modifications in their interaction with salivary protein. Tannin-protein complexes are held together by hydrophobic interactions and hydrogen bonds (see above).

Modifications of the tannin structure could lead to modifications in the ability of the tannin molecule to hydrophobically interact and hydrogen bond with salivary protein. If these changes result in changes in the duration of astringency relative to intensity (Figure 5), then this could be perceived as a qualitative change in astringency.

There is some evidence that seed tannins are oxidatively modified (see above), and oxidation would be expected to modify the tannin structure in this manner. Oxidation of the tannin molecule is expected to modify the A and B-ring portions of the tannin molecule, and create modifications of the hydrogen-bond donor sites, as well as the surfaces responsible for hydrophobic interactions, and would also make the tannin molecule less flexible.

It is predicted that, as a tannin molecule becomes increasingly oxidized, the corresponding protein-tannin complex becomes increasingly dependent on hydrophobic interactions for stability. If the interaction between tannin and protein is initiated by hydrophobic interactions, the complex between tannin and protein would form, but it is expected that the complex would be weaker because hydrophobic interactions are weaker than hydrogen bonding interactions.

It is unclear whether a soluble complex provides as much lubrication in the oral cavity as the uncomplexed protein

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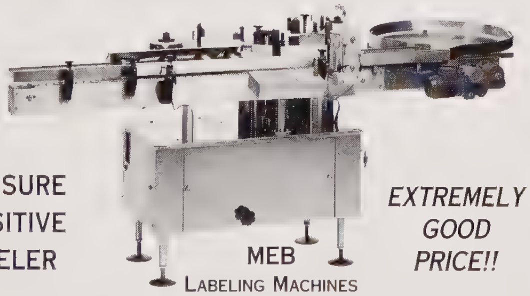

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(*i.e.:* not astringent), or if precipitation is necessary for lubrication to be lost (Figure 4). To use winemaker terminology, underripe tannins would be considered to be tannins that form stronger complexes with salivary proteins (due to higher proportion of hydrogen bonding and increased flexibility), and riper tannins would form weaker complexes.

Theories II and III could both be explained by oxidation and therefore, based on current predictions, both the size distribution and the three-dimensional structure are likely to be affected.

Conclusion

From the above three theories, improving the quality of perceived tannins in red wine begins with identifying whether the tannins are out of balance (Theory I), or whether their structure needs to be modified (Theories II and III). For some red wines, tannin quality could be improved by bringing the tannins into balance with other wine components, whereas, for other red wines, the structure of the tannins themselves may need modification.

Changing the structure of the tannins could take place in the vineyard through cultural practices or careful site selection. It could also take place in the winery by modifying maceration regimes or cellaring practices, although knowledge in this area is based on anecdotal evidence.

It is evident that, in addition to concentration, tannin structure could explain perceived differences in red wine tannin quality.

The task now is to determine the role that these theories play in red wine tannin quality. This requires sensory studies coupled with analytical methods capable of measuring the contribution of the three theories described. In addition, since the skin tannins are also present in red wine,[14] their contribution to quality also has to be considered. ■

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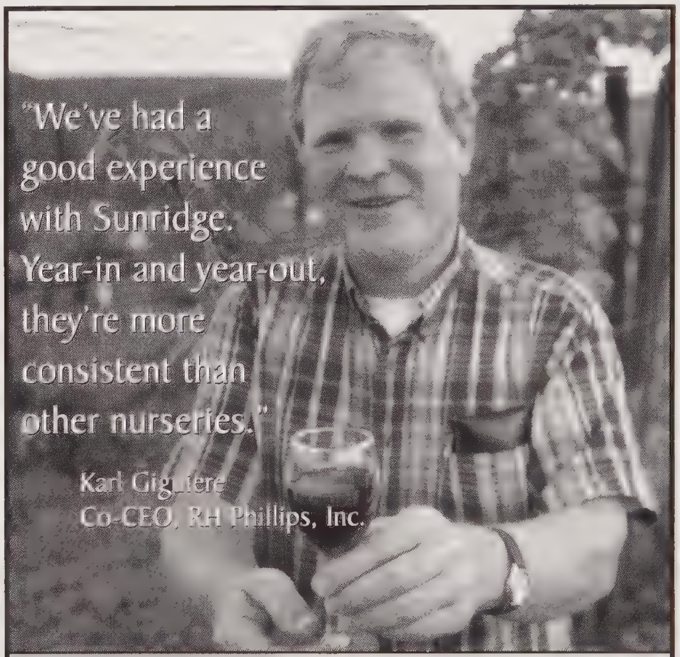
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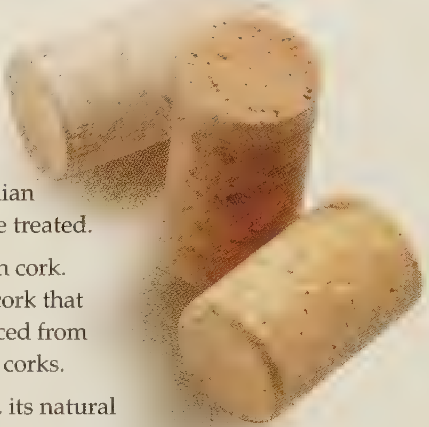

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Five-step irrigation schedule

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BY Stan Grant, Progressive Viticulture

Figure 1: Desirable Cabernet Sauvignon shoot growth during period of regulated stress.

Most winegrape growers and viticulturists agree that irrigation is the most important management practice for quality wine grape production known to directly effect fruit acidity, pH, and phenolics, including anthocyanins in red grape berries.[2, 5, 9, 14, 16, 18, 20, 21] The influence of irrigation on berry size and foliage growth, particularly canopy growth relative to the amount of crop, also may indirectly affect fruit characteristics and bunch rot incidence.

Technological advances in water delivery systems, vineyard water use modeling, and soil moisture monitoring during the last 30 years have given growers many tools for optimizing irrigation for fruit quality. Perhaps most prominent among these is drip irrigation, which has given growers complete control over water application timing and amounts.

A water use model that uses weather data to estimate combined water loss as evaporation from the soil and transpiration from leaves produces values for grape evapotranspiration (ET) which can be used in "check book" method of irrigation scheduling.[6, 7]

Soil moisture monitoring has advanced well beyond the "feel method." Today's technologies include tensiometers, resistance blocks, heat dissipation sensors, neutron probes, frequency domain capacitance sensors, and time domain reflectance sensors (For comparisons of soil moisture measuring instruments see references 10, 11, and 12).

Research and experience have shown that irrigations applied to meet or exceed 100% vineyard water use (such as grape ET) are not conducive to high winegrape quality.[2, 3, 5, 13, 16] Such irrigation management leads directly to reductions in phenolics, decreases in the ratio of tartaric to malic acid, and to excessive growth of the foliage and poor canopy microclimates conducive to disease.

Winegrape quality is improved when reduced amounts of water are applied during the growing season. However, too little irrigation of most vineyards during the growing season is also detrimental to fruit quality due to sunburn, berry shrivel, and impaired ripening associated with insufficient leaf surface and photosynthesis.[3, 9] The questions of how much and when to apply irrigation remain subject to debate.

Regulated deficit irrigation (RDI) involves applying less than the full vineyard water requirement during specific periods of the growing season. It takes advantage of the differing sensitivities of foliage growth, fruit growth, and sugar accumulation to water stress, which are listed here in order of decreasing sensitivity.[22] By inducing controlled moderate water stress, foliage growth and berry size are reduced, fruit quality is enhanced, and sugar accumulation may be unaffected or enhanced.[9, 20, 21]

In Australia, where the concept originated, the RDI method of irrigation scheduling is promoted using soil moisture measurements to determine when to apply water.[9] In California, RDI strategies are being tested using plant moisture status and estimated vineyard water use.[16] These strategies are promising, but they are still in development. Currently RDI is limited by the ability to maintain moderate water stress while avoiding under irrigation and severe water stress.

Partial root zone drying (PRD) is a recent concept that also originated in Australia.[4] It involves alternatively withholding water from each side of the vine from fruit set until harvest. Experimental evidence indicates that roots respond to the drying soil by producing abscisic acid (ABA), a hormone. ABA is translocated to the leaves where it induces closure of the stomata, the tiny pores that allow water vapor to escape and atmospheric gases to enter leaves. The vine responses that follow are those of mild water stress, which result in a reduction of foliage growth.

Table 1

Calculation of irrigation system run time and seasonal irrigation records

Calculation of Irrigation Run Time								Seasonal Irrigation Records	
Date	Reference ET (1) (in)	Crop Coefficient (2)	Grape ET (3)	Management Factor (4)	Application Rate (5) (in/hr)	Irrigation System Efficiency (6)	Irrigation Hours (7)	Accumulated Grape ET (in)	Accumulated Water Applied (in)
Jun 1	0.19	0.55	0.10	0.75	0.026	0.90	3.21	3.43	2.83
Jun 2	0.16	0.55	0.09	0.75	0.026	0.90	2.82	3.52	2.91
Jun 3	0.19	0.56	0.11	0.75	0.026	0.90	3.41	3.62	2.99
Jun 4	0.19	0.57	0.11	0.75	0.026	0.90	3.47	3.73	3.08
Jun 5	0.23	0.58	0.13	0.75	0.026	0.90	4.28	3.87	3.19
Jun 6	0.27	0.58	0.16	0.75	0.026	0.90	5.02	4.02	3.32

1. From a local weather station
2. From a model (e.g. Fig. 2)
3. Grape ET = Reference ET x Crop coefficient
4. Selected by grower based on vine and vineyard observations, and management objectives
5. Application Rate = (Emitters per Acre x Gallons per hour per emitter) / 27154
6. Irrigation system efficiency may be either measured or estimated
7. Irrigation Hours = ((Grape ET x Management Factor) / (Application Rate x System Efficiency)

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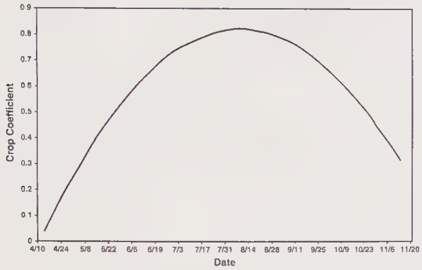

Figure 2: Crop coefficient curve (after Grimes and Williams[6]).

Production of ABA by roots in drying soil is temporary, lasting only a couple of weeks. In order to maintain the vine in a mild stress state, water is withheld from the opposite side of the vine while the side previously dried is irrigated. The cycle of wetting and drying on alternating sides of the vine is repeated several times before harvest.

The end result of PRD is reduced water use and pumping costs, reduced foliage growth, and conceivably, improved fruit quality without the risk of severe stress that sometimes occurs with RDI. In Australia, PRD has been adopted by only a few growers and in California it has only begun to be studied.[8]

Until the RDI and PRD techniques are ready for routine use, the following question remains: How does one manage soil moisture within a vineyard to optimize fruit for winemaking?

The following systematic five-step irrigation strategy is one that we have used successfully at our vineyards in the Linden Hills area of San Joaquin County. It combines elements of both science and art, with steps #1, #2, and #5 predominantly the former, and steps #3 and #4 predominantly the latter.

It normally contains a period of induced water stress for enhancing fruit quality and is therefore, a RDI method. All that is needed for this method is access to reference evapotranspiration (ET) information from a local weather station, calibrated and functional soil moisture measuring devices (the type of device is not critical), frequent observations of vine foliage and fruit, and some simple record keeping. In this method, soil moisture monitoring devices are required at a minimum of two depths within the root zone. The five steps are listed below:

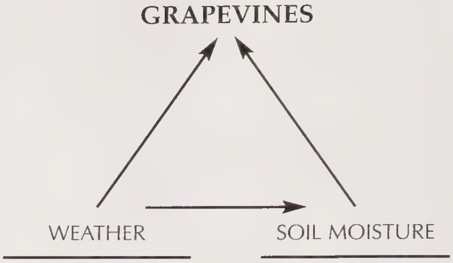

Figure 3: The three components of irrigation scheduling decisions.

1. **Initiate irrigation after soil moisture measurements indicate drying.** Look for a sustained decrease in soil moisture indicated by at least two measurements made a few days apart. Assuming that at the beginning of the

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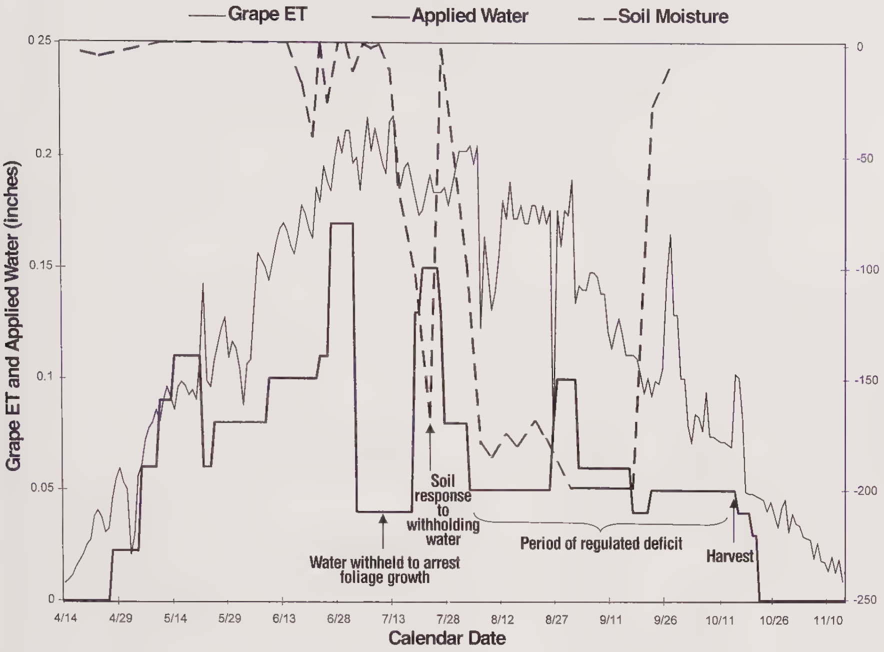
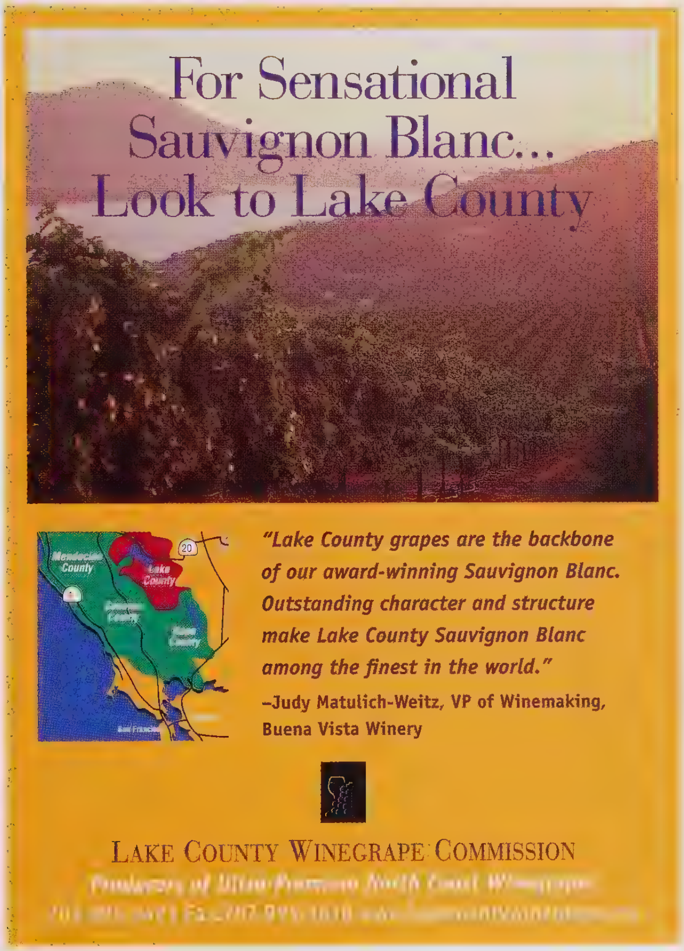


Fig. 4: Estimated vineyard water use (grape ET), applied water, and soil moisture for LindenHills West Cabernet Sauvignon during the 1999 growing season.

growing season the soil profile is full of moisture from winter rains, irrigation before the soil begins to dry wastes energy, water, leaches mineral nutrients from the root zone, and creates an unhealthy root environment conducive to diseases. If the soil is dry prior to budbreak, irrigation will be necessary to assure proper root and bud function as vines come out of dormancy.[17]

2. **Irrigate at 75% to 100% grape ET until the canopy is developed as desired.** During the early part of the growing season, vine resources are directed mainly into foliage growth. During this period it is essential that the amount of leaf surface produced be sufficient to ripen the grape crop (10 to 20 leaves per shoot[18]). If it is not, it will be extremely difficult, if not impossible, to do so later. However, it is critical that a moderate rate and not an excessively rapid rate of foliage growth be maintained for normal shoot development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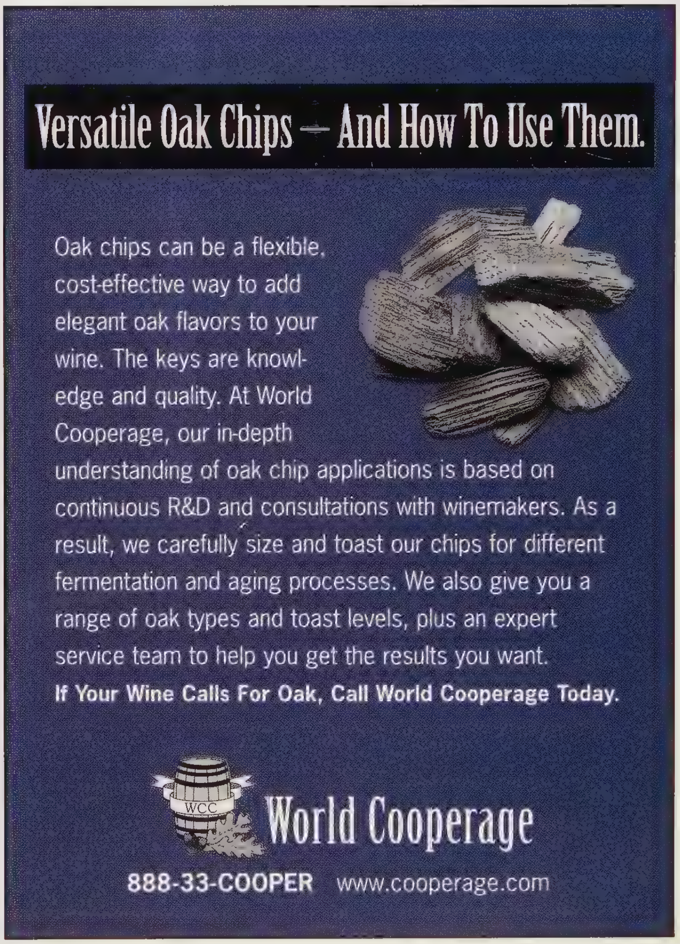
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and minimum competition between developing shoots and clusters.

The crop coefficient used in the ET model represents vine factors that effect water use, particularly the amount of active foliage. Because it was developed with vigorous vines, it sometimes overestimates the water requirement of vines.

During the early part of the growing season, a management factor is included to compensate for small canopies of low-vigor vines. Later in the season, it is based on other management objectives such as maintenance of canopy and berry size. Management factor values are usually discussed as percentages, but must be decimal fractions for irrigation scheduling calculations as in Table I.

3. **Withhold water to arrest foliage growth.** Do not resume irrigation until foliage darkens, the angle between the leaf and the stem decreases, internodes near the tip shorten, and tendrils lose some turgidity. Do not withhold water so long that tendrils wilt, shoot tips die, and leaves near the base of the shoots become excessively chlorotic or scorched. You have invested in the leaves during step #2 and, unless leaf removal from the fruit zone is desired and planned, they are required to perform their sugar-making function at least until after harvest.

4. **Resume irrigation and repeat as needed until harvest, applying enough water to maintain healthy, dark green leaves but not so much as to stimulate renewed growth of shoot tips** (normally between 35% and 50% of grape ET). This is the period of regulated deficit irrigation.

During this time, frequent monitoring and consideration of vine appearance, soil moisture, and estimated vineyard water use (grape ET) are essential to making irrigation decisions (Fig 2). Of the three, vine appearance is the most important, but the others should also be monitored. Leaves should remain dark green and healthy. As the growing season continues, shoot tips and tendrils will likely die and drop. Scorching on leaves low on the shoot indicates too much stress and the need to apply water.

Continually monitor the weather, particularly current vineyard water use (grape ET) and temperature forecasts, and soil moisture. Apply much more water than usual in advance of and during extreme heat to maintain foliage and avoid excessive stress that lead to fruit sunburn, shrivel, and impaired ripening.[9]

During this period, soil moisture readings will vary depending on soil texture and type of monitoring device, but will frequently reach the dryer por-

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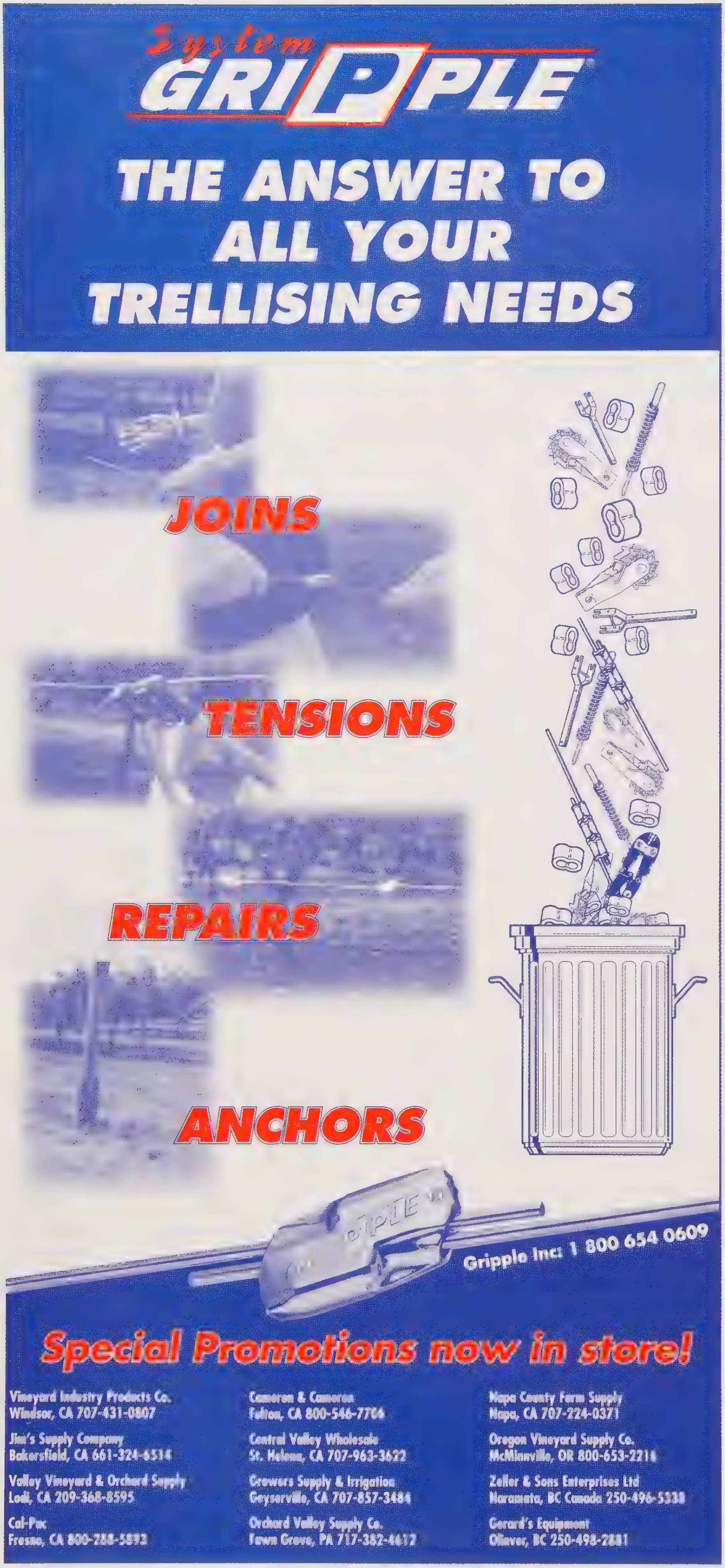
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tion of the available moisture range before harvest.

Mite infestations can sometimes become damaging while vines are being moderately water stressed and frequent monitoring of their numbers is also required. Mite control measures may become necessary.

5. **After harvest, irrigate at 65% to 80% grape ET until the onset of leaf fall,** when irrigations cease. Posthavest maintenance of foliage through continued irrigation is important for storage of carbohydrates and mineral nutrients within the permanent structure of the vine (such as roots, trunks, and cordons), which in turn is important to vine health and resilience during the next growing season. After prolonged drying during step #4, soils with high clay content may require a few long irrigations to rewet.

Summary

An example in 1999 of grape ET soil moisture tension, and irrigation water applied is in fig. 3. The photo in figure 1 illustrates the shoots from a Cabernet Sauvignon vineyard during the ripening period prior to harvest. This vineyard experienced a mild ripening season water stress with moderate soil moisture depletion.

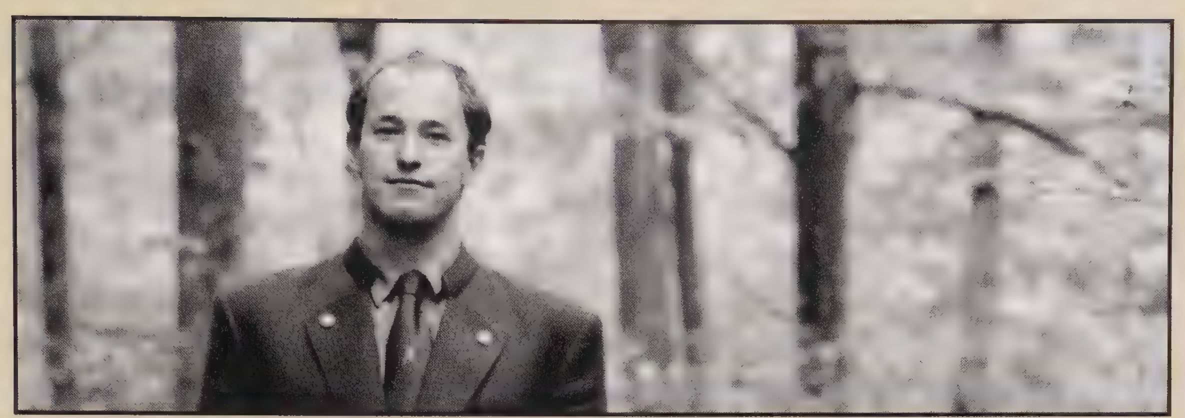
Note that after the onset of irrigation in this vineyard, water was applied almost every day. Water need not be applied this frequently, but the time between irrigations should never exceed one week.

In fig. 3, the difference between the grape ET curve and the water applied line is the management factor. The management factor is determined by the grower based on management objectives and decisions based on vine appearance, weather forecasts, grape ET, and soil moisture. The management factor varies somewhat from year to year, due to variations in conditions such as nutrient status, crop load, and effective leaf area, but after a few years, an average line may be calculated and used for planning and scheduling.

The earlier in the growing season that foliage is produced, the earlier water can be withheld to impose a regulated deficit. Moderate water stress prior to veraison frequently results in

Continued on page 75

SUSTAINABLE
-1789-



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Imagery technology meets vineyard management

BY Jamie Carothers,
Agricultural Market Director,
Vestra Resources,
Redding, CA

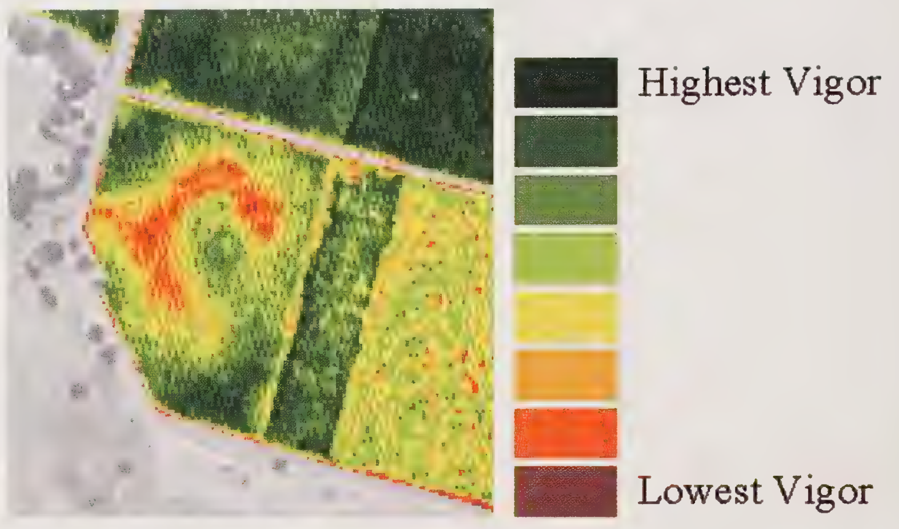
From the beginning, winegrowing has been a marriage of art and science. The increasing use of remote sensing and geo-technology in vineyard management to help improve efficiency, increase production, and produce high-quality grapes simply underscores this fact.

Today, remote sensing, or imagery, includes an ever-increasing variety of tools that help growers identify variations in vineyard vigor and stress levels, pinpoint problem locations in the vineyard, and correlate them with underlying vineyard topography. As a result, growers can have a better grasp of what's happening in their vineyards and why than ever before.

Vineyard managers first began using multispectral imagery as a tool for vineyard management in 1993. In its earliest form, the imagery — which is a picture of multiple bands of light waves reflected from the vegetation and the earth in a specific area — stood alone as a photograph and was essentially used as a rough indicator of plant vigor. These were called infrared photos. Dense vegetation showed as bright areas on a photographic image. The information was useful, but a dense canopy only tells part of the story of plant health.

More recent developments in imagery use a digital rather than a photographic image. This information can be spread like a "blanket of numbers" across a vineyard map on a computer. By combining multispectral imagery with digital maps of soil types, irrigation, elevation, rootstock, clones, nutrients, disease and pest problems, growers can see their vineyards in virtual reality.

By managing this information in a computer-based geographic information system (GIS) and supplementing it with on-site observation, they can use sophisticated software and mathematical formulas to analyze relationships in the data. This gives growers a broader perspective on vineyard problems and helps them identify nutritional deficits and irrigation needs, plan harvest strategies, confirm picking decisions, and track costs, among a host of other possibilities.



In this multispectral imagery of Gordon Family Ranch in Napa County, the orange "C" shape shows vine stress at the top of a hill. The imagery map was used to locate the vines and modify the drip irrigation after harvest.

The historical context

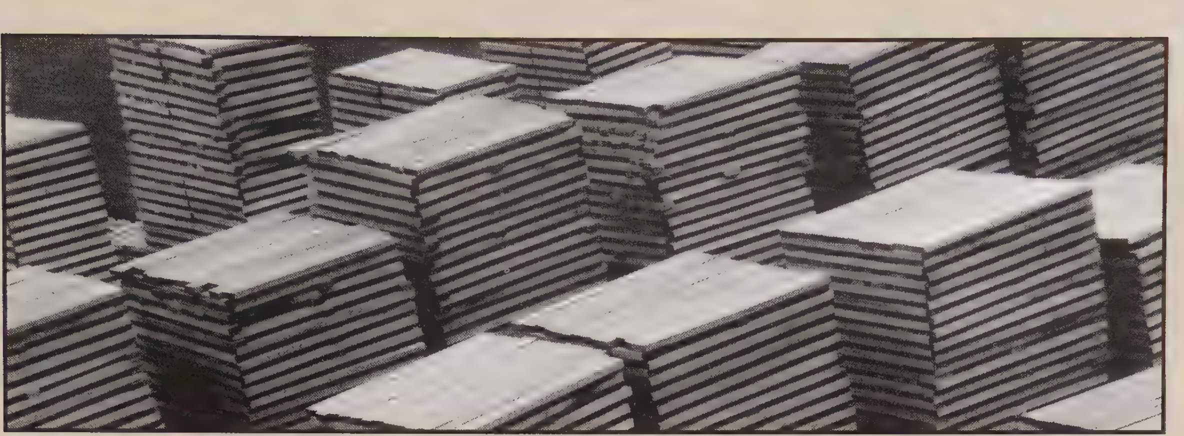
Use of multispectral imagery was introduced to the wine industry in a 1993 to 1995 collaboration with the National Aeronautic and Space Administration (NASA). The Grapevine Remote-sensing Analysis of Phylloxera Early Stress (GRAPES) used airborne imagery to examine vineyard damage caused by phylloxera. The 1997 Canopy Remote-sensing for Uniformly Segmented Harvest (CRUSH) demonstration showed that image values can ultimately be related to wine quality in uninfested vineyards.

Currently, NASA is involved in Viticultural Integration of NASA Technologies for Assessment of the Grapevine Environment (VINTAGE). Launched at the end of the 1999 growing season, this project's objectives are clearly stated at the NASA project website. "The VINTAGE Project objectives are: 1) to continue the development of remote sensing as a tool for field segmentation and optimization of grape harvest, 2) to adapt and validate an ecosystem model (that uses remotely sensed input) as a tool for improved management of vineyard water stress, and 3) to test recently developed techniques for remote sensing of water stress indicators in discontinuous crop canopies (such as vineyards)." (Website is *http://geo.arc.nasa.gov/sge/-vintage/vintage.html.)*

Investigators are drawn from NASA's Ames Research Center, California State University, University of California, Lawrence Berkeley Laboratory, and the University of Montana. Collaborators include the Robert Mondavi Winery, Oakville, CA; VESTRA Resources, Redding, CA.; and the not-for-profit Bay Area Shared

CONSISTENT

-1950-



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Information Consortium, Mountain View, CA. Growers will soon be able to see results of the research.

Wine industry collaboration is motivated by NASA's general interest in transferring its investment in earth science and technology, in this case expertise in image understanding and ecosystem modeling, to U.S. industry.

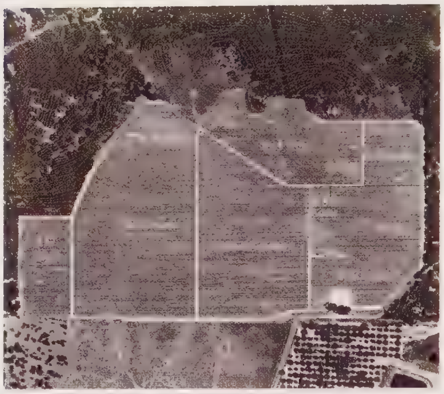
Multispectral imagery typically measures energy reflected from the earth's surface in the blue, green, red, and infrared spectral regions. Processing of the imagery to Normalized Difference Vegetation Index (NDVI) is one type of analysis that helps growers extract information from their multispectral imagery. NDVI analyzes the difference in response between the red and near infrared and is highly sensitive to leaf area index — an indicator of vigor — of the vegetation canopy. The NDVI compensates to a certain degree for changing illumination conditions, surface slope, aspect, soil brightness, and other potential confusion factors.

Using a GIS, GPS or an orthophoto, growers can tie multispectral imagery to coordinates on the ground, giving them the ability to focus on smaller vineyard segments. Using smaller vineyard segments or vineyard blocks, growers gain a much more complete view of the vine health or stress within that area. This allows growers to apply the vine health information to such applications as a plan for differential harvesting or irrigation modeling.

Digital black-and-white orthophotography

Another valuable tool used in remote sensing is orthophotography. An important component for accurately mapping and locating vineyard features, orthophotography is black and white digital aerial photography that uses surveyed control points or survey grade GPS to geo-reference the image. It is corrected for terrain features.

The digital orthophoto is then incorporated into a GIS where it can be used to geo-reference multispectral imagery. In the GIS, various layers of information can be overlaid to view complex relationships as a map. An orthophotograph is usually less than one-meter resolution, and shows two- or five-foot contour lines.



Orthophotography of Snows Lake Ranch producing vineyard in Lake County, with five-foot contours. When used in GIS, the photography provides an accurate digital base map on which to overlay other GIS layers. Contours can be used in GIS analysis to provide information for vineyard design, layout of rows, and erosion control plans.

Current California survey laws require the use of a licensed surveyor to do instrument or GPS work that involves production of contour maps used to make orthophotos. Orthophotography uses a digital elevation model to correct the high-resolution multispectral imagery of terrain distortions caused by hills and valleys and to geo-reference it, and survey work becomes unnecessary for accuracy.

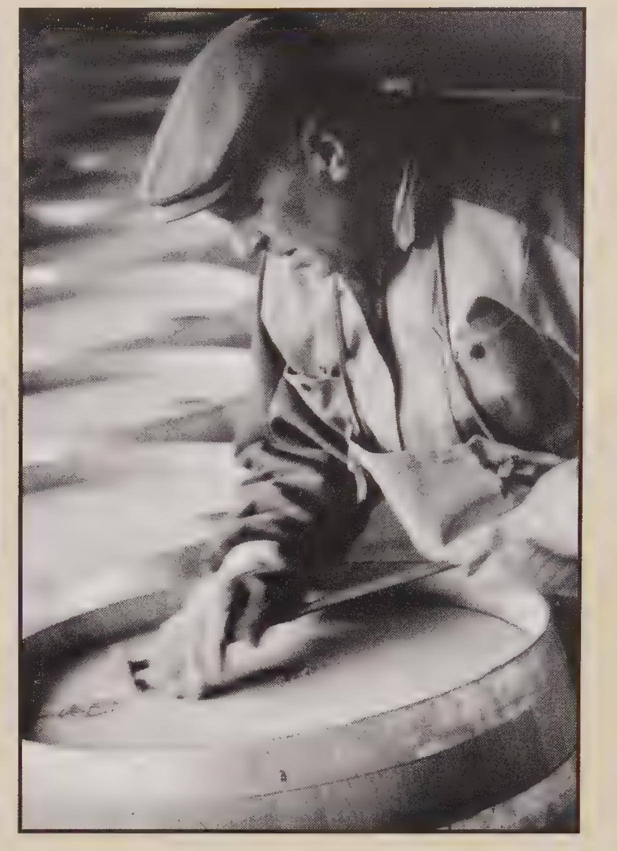
Digital Multispectral Imagery

The level of resolution needed in multispectral imagery is best determined by what you are using the imagery to see. For example, if you want to see an individual grape vine, two-meter resolution is best. If you want to see an entire vineyard block, four-meter resolution would be appropriate. Resolution is defined by pixel size. Pixel means picture element and is the basic unit of data collection in multispectral imagery. In a digital image, pixels are the tiny squares that make up the picture. A single pixel in one-meter imagery is one-meter by one-meter, or about three-feet by three-feet.

Cost, data volume, and usefulness are the factors to consider when selecting the proper resolution. Vineyard managers have been using both one- and two-meter multispectral imagery,

HANDCRAFTED

-1989-



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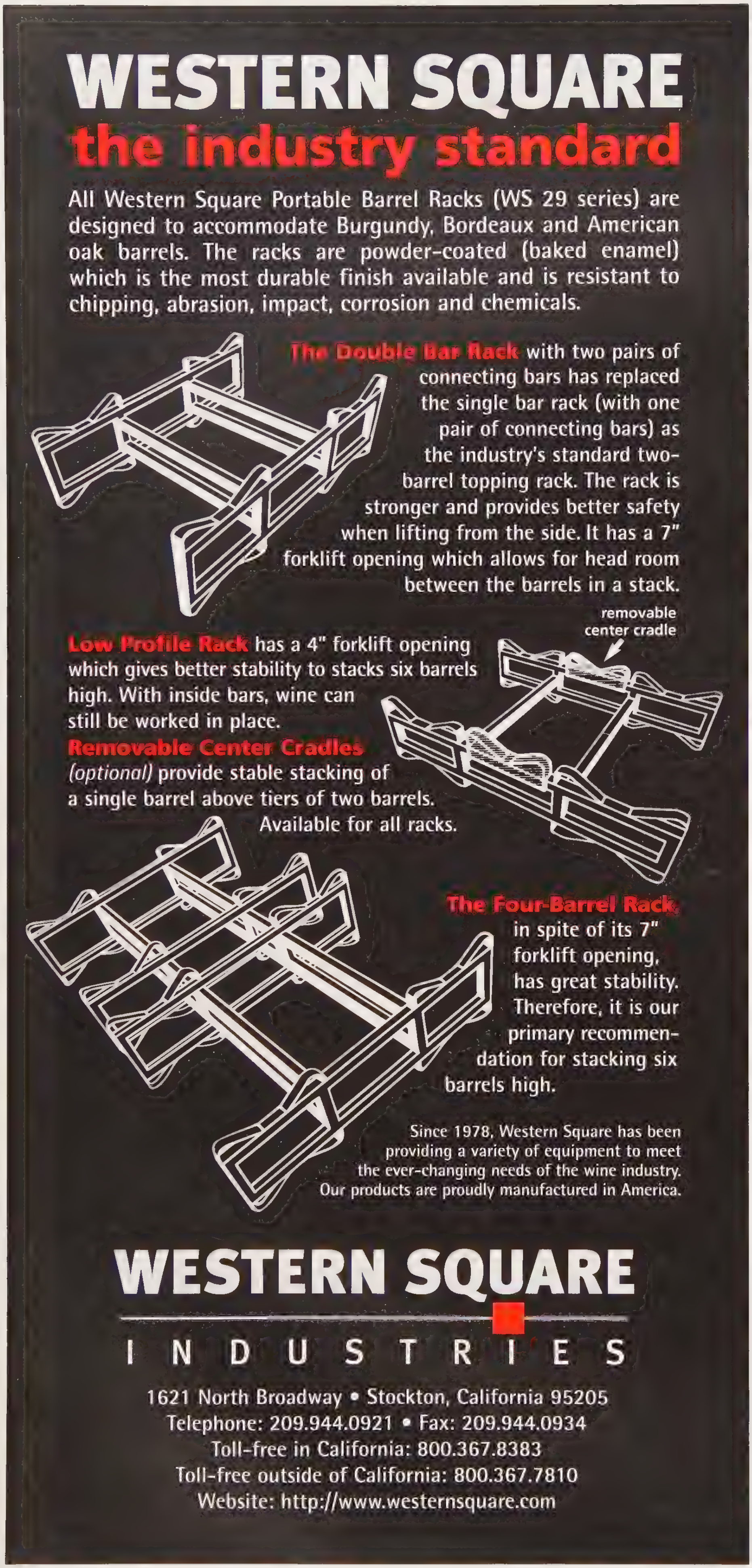

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and four-meter imagery is now available via satellite.

A one-meter image requires four times the data volume that a two-meter image requires. As a result, the one-meter image costs four times as much to acquire, process, and analyze. Most vineyard managers believe that two-meter resolution imagery provides useful information at a reasonable cost.

Because vineyard managers are dealing with a permanent crop, they usually contract for multispectral imagery once each year. These snapshots give them an annual view of vine health. As imagery and processing costs drop, vineyard managers may order multiple images per year, especially if they adopt new technology, such as remote control irrigation or precisely applied pesticides and herbicides.

Using imagery

Vineyard managers are using imagery to assess plant health annually, for irrigation management, and as a property development tool. It allows them to monitor nutrient status, prescribe irrigation, and assess disease. Distressed vines experience decreased vigor, which can be detected on imagery. Vineyard managers then field check the area to identify the cause of low-vigor. After the field check, managers can use imagery to limit corrective measures to the affected areas, instead of an entire vineyard block.

Imagery helps identify areas that may need improvement in the irrigation system. For example, if a vineyard image shows stress at the top of a hill, a field check of the irrigation system may show that those vines are not receiving adequate water.

Vineyard managers using remotely controlled irrigation systems may benefit from acquiring imagery several times each year. They can use the imagery to adjust irrigation volume and timing to address specific weather data and microclimatic conditions.

In vineyard development, imagery information about an existing vineyard that produces high-quality grapes can serve as a road map for a winery developer who's seeking similarly suited vineyard sites. Such information might include soil types and depth, slope and

PROVEN

-2000-

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exporting art.

(Viansa Winery)

The view is breathtaking. Standing on top of a hill overlooking the lush Sonoma valley, Sam and Vicki Sebastiani raise their glasses for a toast, admiring the land on which they will build their dream. It might not be Tuscany, but (*con't at www.svb.com/viansa*)

i will persist.

(Rombauer Vineyards)

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the joy of wine.

(Ken Wright Cellars)

Lexington, Kentucky is a long, long way from the Willamette valley. But for Ken Wright, that's where it all begins. Waiting tables at the quaint Fig Tree restaurant, he develops an insatiable curiosity for wine. One that will lead him from the bluegrass (*con't at www.svb.com/wright*)

CHAPTER TWO. *The Journey Continues. (on the web sites above.)*

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aspect constraints, and desirable elevation. Black and white orthophotography provides a preliminary base map, showing the features of the land.

Not everyone who uses multispectral imagery chooses the same path. Some growers use it to help manage all aspects of their business; others prefer to use it on a limited basis. The following growers offer examples of how multispectral imagery might be integrated into your program of vineyard management.

Imagery for harvest scheduling at Robert Mondavi Winery

At Robert Mondavi Winery, vineyard technical manager Daniel Bosch is an imagery pioneer. He is participating in GRAPES, CRUSH, and VINTAGE projects, and uses multispectral imagery for differential harvesting to maximize grape quality.

Before harvest, Bosch walks through the vineyard, laptop computer in hand. On the screen is multispectral imagery processed as a geo-referenced NDVI image. He spots vigor variation on the NDVI image and flags those portions of the vineyard to be harvested accordingly. The winery also uses the traditional methods of assessing ripeness — fruit tasting and sampling for sugars, titratable acidity, and pH. But now, harvest can be scheduled according to which grapes are actually ripe rather than harvesting entirely by block.

The results are improved and consistent wine quality, a greater proportion of premium quality wine, a consistent product for consumers, and more profits.

Bosch also uses multispectral imagery to assist vineyard management in other areas. Before the 1997 harvest, Terra Spase provided imagery of a Mondavi vineyard block in Carneros that includes about seven acres each of Chardonnay and of Pinot Noir. Bosch used the imagery to achieve consistent crop load by identifying areas where bud count or irrigation management could be improved.

In 1998, imagery data helped guide replanting of 50 acres of the winery's Carneros ranch. Two blocks of 25 acres each were divided into seven blocks of different plantings to achieve uniform vigor.

In 1998–99, VESTRA provided imagery with one flyover in late July/early August to confirm that these vineyard management changes achieved the desired effect on the vigor and growth of the Carneros Chardonnay and Pinot Noir block. VESTRA also provided data on a block of Merlot in Carneros and on plantings of Cabernet Franc and Cabernet Sauvignon in Oakville. In 1998–99, Mondavi requested multispectral imagery on 18 vineyard blocks, under 200 acres total.

The new VINTAGE project imagery provides Robert Mondavi Winery with more information to consider when scheduling harvest; when analyzing pest problems, water usage, nutrients, and cover crop impact; when trying to predict moisture stress; and when measuring heat stress in vines. Bosch will use some satellite imagery in 2000, which is generally four-meter by four-meter, but he prefers higher resolution. "We like the two-meter by two-meter resolution for harvest, which we think is the best combination of cost, vigor grouping, and size of computer file."

Imagery informs vineyard management

Gordon Family Ranch (GFR), located in Gordon Valley in southeastern Napa County, was once a walnut orchard/ranching operation. Then in 1982, Don Gordon Sr. began converting 200 acres of walnuts to Merlot, Cabernet Sauvignon, Chardonnay, and Zinfandel.

In 1996, GFR began building a GIS with imagery as the cornerstone with one annual flyover pre-harvest. Gordon uses digital imagery — black-and-white orthophotos and annual multispectral images — with geo-referenced field data, such as soil maps, pruning weights, trellis type, yield information, and irrigation schedules. Orthophotos help build a vine-by-vine accounting of each vine's rootstock, clonal selection, and its location in the vineyard.

As he walked the vineyard before harvest in 1999, Gordon noticed decreased vigor in one area on the multispectral imagery. He checked out the area indicated and found stressed vines at the top of a small hill. He made a mental note to go back after harvest to change the drip system to deliver more irrigation and fertigation to that area.

When he returned, he was able to use the imagery taken in August as a refer-

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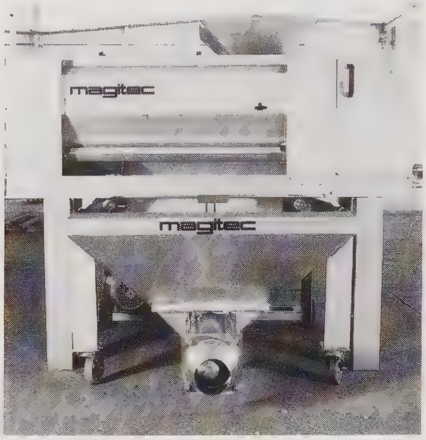

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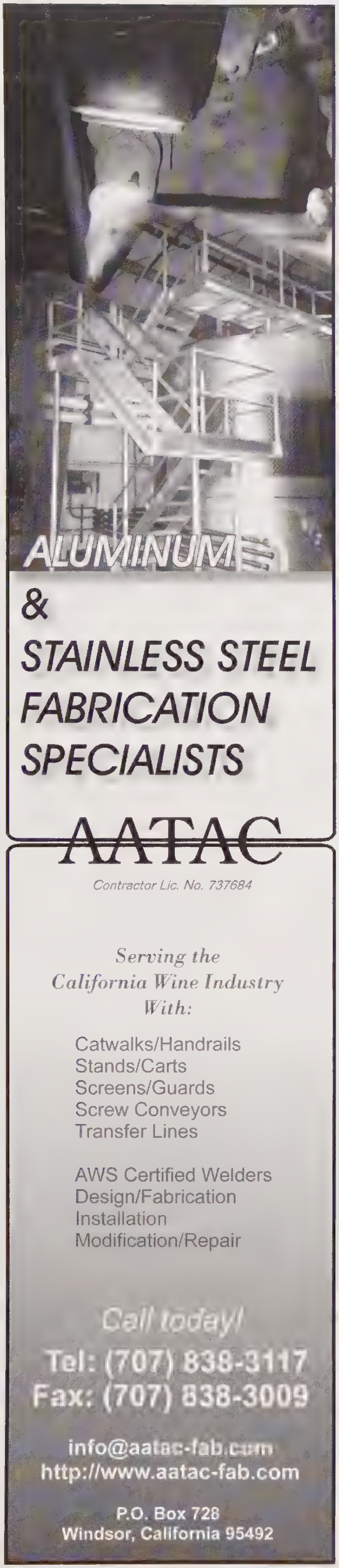
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ence map to locate the right area to make the necessary irrigation adjustments.

In the future, Gordon says, he may use NDVI to analyze correlations among the 10 vineyard blocks — looking at soil maps and grapes sampled for quality, for example. If a correlation is established, he expects this will be valuable information for vineyard expansion.

Imagery for development and management at Snows Lake Ranch

David and Cynthia Orr are partners in managing the development of 1,200 acres of premium red varietal (85% Cabernet Sauvignon) vineyard near Lower Lake in Lake County, CA. David is the vineyard manager and Cynthia is a GIS analyst. Snows Lake Ranch is a hillside vineyard with elevations ranging between 1,900 to 2,512 feet.

Since 1997, they have cleared 900 acres and, since 1998, have planted about 600 acres to Cabernet Sauvignon, Cabernet Franc, Merlot, and Petite Sirah. The vineyard has 19 soil types.

Early on, the Orrs decided to include all their vineyard development information in a database that can be accessed using GIS. They have used imagery from the beginning of the vineyard development project.

The first step was an orthophoto of the proposed vineyard. VESTRA used the orthophoto to map contours, slope, and aspect layers that were essential in planning the vineyard, and the Orrs plugged this data into their GIS. This was the first layer, the foundation to generate the background of all the subsequent vineyard data.

Next, Cynthia overlaid a digital map of the ranch soils data derived from soil pit analyses using GPS coordinates of the soil pit locations. The resulting digital map served as a planning tool as David designed virtual vineyard blocks in the plantable areas of the ranch. He used the data to help select rootstock that is compatible with the soils at each site.

"As I found myself interacting with each vineyard block on complex slopes, I could identify future problems or potential failures, such as erosion, drainage concerns, irrigation complexities, row orientation, aspect, and rootstock and clonal decisions. Using GIS, I was able to eliminate costly problems by virtually managing the vineyard on the computer before ever spending money and labor," says David.

"The GIS helped determine row directions, aspect, sideslope, and spacing on the slope." The Orrs' consulting engineers, surveyor, and irrigation designers used the information to identify the best possible well sites and create an irrigation design.

George Myers, owner and president of Snows Lake Ranch, has used the imagery maps of the ranch to track and monitor development cost projections for the improvements on each parcel. They have also been handy to communicate the vision of the ranch to potential grape buyers.

For the 64-acre portion of the vineyard producing grapes, David and Cynthia used NDVI to analyze multispectral imagery, gathered from annual flyovers at veraison in 1998 and in 1999, which gave them an assessment of vine health. "Using this information, we can design better irrigation, check our fertilization concerns, and monitor ripeness and yields with each block," comments David.

High-resolution imagery provided by VESTRA has also helped David isolate contiguous wildlife corridors within the ranch and vineyard, so they can be preserved.

Cynthia is developing an extensive vineyard database of information that will be mapped on top of the vineyard blocks and be viewed as a spreadsheet or a map. In the financial area, she is creating digital maps that show costs for labor, irrigation, materials per vine block, and for service providers. She is also creating maps for weather data, neutron probe data, pesticide use, petiole data, phenology, rootstocks, and clones.

The Orrs can use the maps to isolate independent blocks or to assess a single vine, and they can look at multiple variables at once, such as date planted, vine status, water usage, scion-clone and rootstock, nutrient status, and grape buyer.

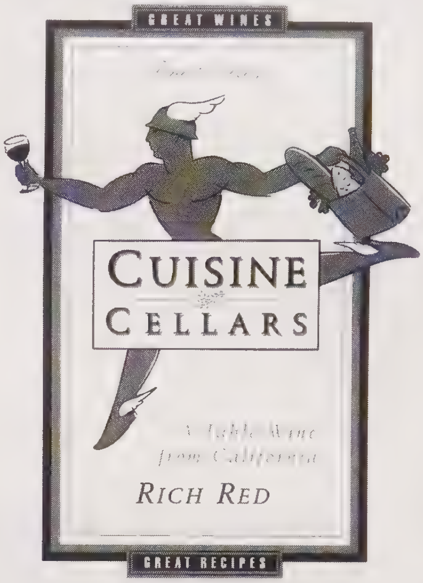
"With this technology," says Cynthia, "I will be able to give David an estimated ripening map for harvest that will show the order of ripeness for all blocks, based on varietal, aspect,

Continued on page 102

SAVVY MARKETING

Don't confuse *your* customers

BY Eleanor & Ray Heald • Contributing editors



"We who live and breathe the wine industry every day believe we come up with clever ideas," Brand Partners LLC visionary Bruce Rector says. "Face it, that's how we entertain ourselves."

In ***PWV*** (Jan/Feb 1997), Rector and his associates in Brand Partners were interviewed about their Cuisine Cellars of Sonoma brand. It was a product of Rector's desire to make it easy for wine drinkers to choose a wine and match it with healthy cuisine that could be easily prepared at home. The brand failed.

PWV recently revisited Brand Partners to discover what advice Rector can offer on the hard lessons of launching what were thought to be innovative concepts, only to see them fold. Rector says the most important take-home message is: Don't confuse your customers. The second lesson is: Don't functionalize and lose the magic.

Rector had already had a successful career as general partner, director of grower relations, and chief enologist at Glen Ellen Winery (Glen Ellen, CA). His grape sourcing and wine blending skills catapulted Glen Ellen's fighting varietal category to the top of the charts.

After the Benziger family sold the Glen Ellen brand, Rector began looking for a new project. He brainstormed innovative ideas with former Glen Ellen and Benziger Family Winery employees and others with broad wine and food industry experience. The result was Brand Partners LLC and its first project, Cuisine Cellars.

Post mortem

"What worked is in the short column and what didn't is in the long one," Rector admits. "To understand our errors, I had to analyze where the wine business is today."

He views wines of commodity as one extreme on the wine brand spectrum and wines of origin at the other extreme. With wines of commodity, price is the paramount selling point.

With wines of origin, soil is the basis of the wine's message to consumers, because "this flavor only comes from this dirt." While this concept is arguable, it easily places a wine as part of a geography. It might be called "the magic of *terroir*" and includes all winegrowing elements.

In between these two, and operating as some sort of hybrid, are wines of personality. Here, the winemaker, viticulturist, owner, or winery itself projects an image that sells the wine.

"When one thinks of Fetzer," Rector offers as an example, "it's not the owner or the senior winemaker, or even the wines, that persuades consumers to buy, but rather it's an aura that is symbolized by the winery. It's the visitors center, the organic gardens, and what these have done to better place wine at the table as a mealtime beverage. Fetzer created man-made magic. Consumers buy into it.

"There's intrinsic power with matching wine and food versus root beer and food or nonfat milk and food. Wine creates connection (consumer identification), but in creating an innovative brand, it is essential to keep in mind that one's potential consumers have a life not necessarily intrinsically involved with your idea.

"Since this is true, another piece in the marketing puzzle is added. You have to ask: Are consumers getting what we're saying about the brand? They don't necessarily have to articulate it, but can they appreciate it?

"Can they sense that they are going to have a more connected experience with everyone at the table, with the place, with the winery, when they serve wine versus sparkling water?

"Wine is intrinsically at the top of the heap for its ability to connect, but a brand will only be successful if it makes that connection easy for the consumer to understand.

"The difficulty in doing this with wines of commodity is that they need some other hook because, in this category, all that matters to consumers is the price and secondarily what the wine tastes like. They don't care about origins."

Off-the-mark packaging

Cuisine Cellars' first label depicted the god Mercury dashing home (supposedly from a grocery store) with wine in one hand and an overflowing grocery bag in the other. In-house at Brand Partners, the dashing figure took on the moniker "blue man" because of his label color.

"Blue man ended up falling out of the mental matrix in which most people think wine should be," Rector says. "Wine consumers are a lot more conventional than we first assumed. They didn't get blue man's message."

Rector thought that blue man's message couldn't be missed. The message was reinforced by a recipe, complete with shopping list, to match food with the wine inside, but the front label did not direct consumers to look for the recipe. The wine sold easily to chain buyers because they understood that Cuisine Cellars wine fell somewhere between wines of personality and wines of commodity, but once it was on the retail shelf, consumers came along and asked, "What is that?"

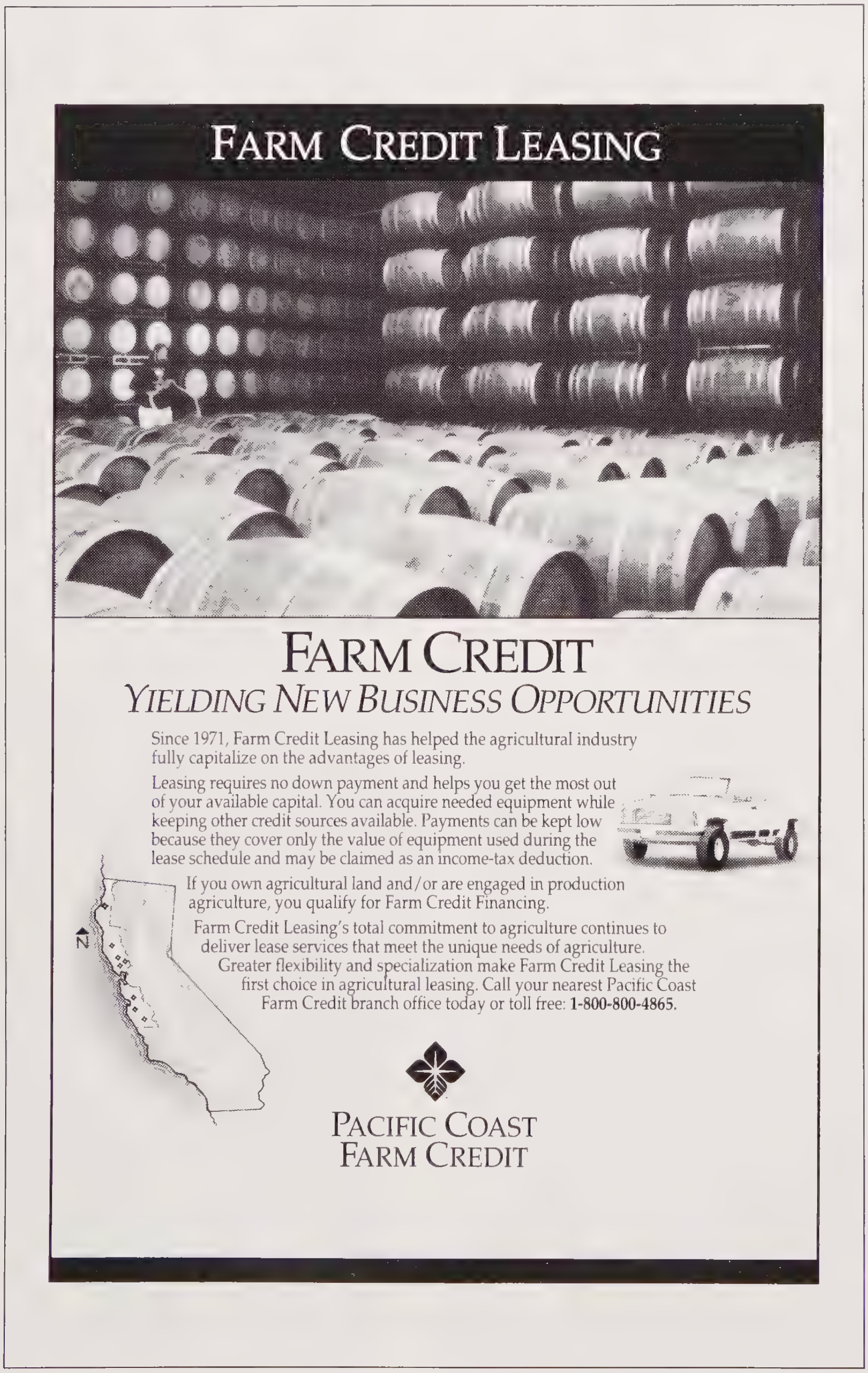
"Some consumers thought it was cooking wine," he explains.

Competition creates so many choices in the wine business today, explains Rector, that the instant that someone asks "What is that?" you're finished. Consumers don't want your product, because there's no perceived payoff. It's like dental floss — the payoff is not immediately perceived.

With no payoff communicated by the wine packaging, consumers have no motivation to try to resolve the confusion. They simply choose a different wine.

Reinvention misses again

Blue man tried to get his message across for 18 months, but failed. In summer 1998, Cuisine Cellars reinvented itself, adopting straightforward packaging with a more stereotypical label that included food items as a border. Blue man was laid to rest.



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The new label, Brand Partners thought, looked just like another bottle on the shelf and was what they wanted for the Cuisine Cellars makeover.

"We wanted to fall into the current mental matrix," Rector contends. "The capsule we thought was absolutely great also had food on it. Unfortunately, between the capsule and the label border, again people really mistook it for a cooking wine. We confused customers a second time."

"We believed that Cuisine Cellars was a gimmick to sell a wine of commodity," Rector adds. "It was the hook every wine of commodity needs. But if you sell the gimmick too hard, people really react adversely to it.

"It's like art on a wine bottle. People say, if this wine is so good, why did they have to put expensive art reproduction on the label?

"People are so skeptical. Our culture has taught them to be skeptics and the 'buy' switch goes to off; not to 'Gee it looks interesting and I ought to investigate.'"

Give a Who G.A.S. test

Along with label redesign in 1998, Cuisine Cellars also changed its wine portfolio. In the first launch, one Cuisine Cellars wine was labeled Light-Hearted Red. Consumers didn't know whether it was diet wine or low alcohol. They were also confused by a bottling called Rich Red. Because of blue man's appearance, some thought the wine was an FTD (Floral Transworld Delivery) closeout. Looking back, Rector acknowledges that the labeling just got too cutesy.

At the time, however, brainstorming of ideas was just among the Brand Partners, and they were in love with the labels and other concepts.

"In hindsight, we should have run our original ideas through a focus group," Rector says. "I advise giving any offbeat concept the Who G.A.S. (Who Gives a Shit) test.

The group believed that if the front label told consumers to look for the recipe on the back, it would smack of even a bigger gimmick or lead consumers to thinking it was a cooking wine.

Wouldn't a strategy such as shelf talkers have overcome consumer confusion? Brand Partners produced shelf talkers, but encountered the obstacles all shelf talkers do — not all stores allowed them, and there was no way to know whether the shelf talkers were used when they were allowed.

"We wanted the recipe on the back label to be, to use the Cajun word, *lagniappe* — an added value," Rector continues. "We thought people would react, 'Far out; an answer to the problem of matching wine and food with a simple-to-prepare dinner.'" But they didn't.

In their defense, Brand Partners had been prompted by a survey that they felt confirmed their Cuisine Cellars concept. Calls were made to homes and the question, "What are you going to have for dinner?" was asked. People who had no idea totaled 70%. The other 30% said they thought they'd go out to eat.

"In addition to providing a recipe, the healthy food message was also on the Cuisine Cellars packaging," Rector adds. "People want to talk healthy food, but that's not what they are eating. That's partly because converting to healthier styles of eating requires cooking at home."

A 1998 *Wall Street Journal* article reported that Americans are buying more cookbooks but are doing less cooking at home than ever before. "I think people are into the virtual enjoyment of food — reading recipes and watching chefs cook on TV," Rector adds.

Getting the message out through print media ads was deemed too costly Rector admits. "In the words of Thomas Jefferson, I thought truths about Cuisine Cellars as a wine were self-evident," Rector admits.

What about cross-merchandising? Keen on the idea of cross-merchandising from the get go, Rector now colors the concept in one of two shades of hopeless. Brand Partners found that grocery stores and supermarkets failed to see the sales potential of placing products in two different parts of a store.

Functionality dispels the magic

To make a functional product like Cuisine Cellars "cool," Rector now realizes, takes significant educational power, particularly through print ads. He points to bag-in-box as one commodity wine concept that has been successfully marketed on the basis of its functionality.

"However, it's not the wine that people are buying," he notes. "People who buy a bag-in-box wine want a delivery system that is always available in the refrigerator. Another issue is they don't want to know how much they're drinking, thank you. They don't want their consumption to be measured. An added benefit is that the box doesn't go 'Clank' in the recycling bin and let neighbors know how much they are drinking.

"The danger of being on the wines-of-commodity side of this business is that you start to lose the sound social reason for wine, a mealtime beverage. You lose the magic.

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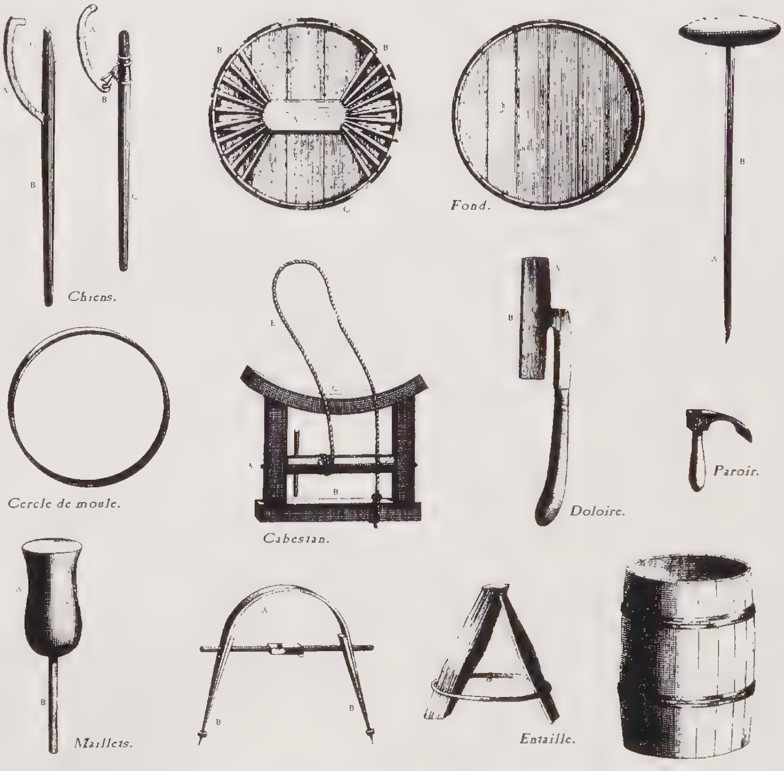

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May 1, 2000 Bird Damage Control Bulletin

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“I utilized the Bird Gard ABC on a commercial farm to protect the winegrape cultivars ‘Merlot’ and ‘Cabernet franc.’ Both the grower and I were impressed that your device appeared to significantly lower bird pressure on this planting.”—Thomas J. Zabadal

University of California Davis, CA

“With the start of bird control with distress calls in the Bird Gard ABC, crows virtually abandoned two orchards. Damage decreased at all sites compared to 1997. Crop losses ranged from $22/ac to $138/ac in 1998 compared to $46/ac to $1,015/ac in 1997. The decrease in damage represented significant dollar savings of $998, $3,642, and $5,914.”—Paul Gorenzel, Horticulturist

Rutgers Univ.–Mays Landing, NJ

Dr. Gary Pavlis of Rutgers says: “The 1994 harvest was virtually left undamaged due to the Super ABC.

“I was very pleased with it and would not hesitate to recommend it for grape growers.”

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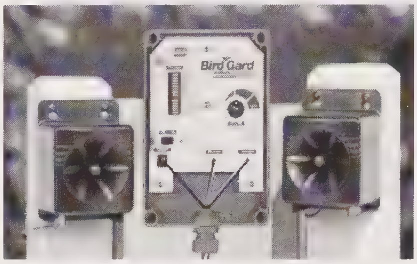
According to Tim Johnson, Research Specialist, “The Bird Gard does a good job of scaring birds and it also does a good job of attracting predators. More than once I saw a hawk actively looking for distressed birds when the distress call sounded.”



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“Abandon any concept of trying to functionalize wine,” advises Rector. “It's not bankable.”

This is exactly the mistake Rector and his colleagues made from the outset. The concept for Cuisine Cellars brand was born when Rector saw a woman in a Montecito, CA, Safeway struggling to select a bottle of wine.

He says her face had a look of total despair and suffering. He thought: “She doesn't deserve this. She deserves better. I'm going to help her. She needs somebody to sort this whole thing out.”

So Brand Partners created a tool to help her out of her dilemma. Making the wine a tool was functionalizing it. In Rector's mind, this was good. It placed wine squarely with food. He said to himself, “I'm going to personally make the wine and test the recipes. Then this woman and others like her will have confidence in their wine choices. They'll know they'll never be embarrassed by Cuisine Cellars. That was my mission.”

By functionalizing the wine, though, Rector broke the magic. Function breaks the magic.

Don't ever break the magic! “What I forgot is that if you want to consort with wolves, prepare to be eaten,” he concludes. “I was playing a commodity game where the low-cost producer ultimately wins. That worked for Glen Ellen, which was a commodity wine, but it had a lot of personality backing it.”

Rector believes the biggest reason that Cuisine Cellars as a brand is dead is that Brand Partners viewed their portfolio as wines of personality rather than as commodity wines. This was evident in the packaging.

“That just doesn't work,” Rector emphasizes. “Don't bank on any situation where you are trying to create a personality without a winemaker, viticulturist, or winery aura. We were trying to create a virtual personality.

“It was all there, but blue man couldn't show up at a tasting; he didn't have a winery or specific vineyard people could visit.”

Moving forward

Brand Partners has happily moved on to wines of origin with some of California's best known vineyards. Their trademark is Abundance Vineyards, a portfolio of vineyard-designated wines only, launched in 1999. ■

Production Economics:

Why Custom Crush?

BY **Tary Salinger**

Due to the sheer nature of its agricultural product, the wine industry is very cyclical. One year brings boom while another brings bust, not only in wine production but in sales growth, stylistic preferences, and foreign versus domestic trends. The predominant cycle of the next few years will see the industry dealing with abundance of fruit and shortage of production capacity.

In its history, there may never have been a time when the supply of fruit put so many demands on the capacities of the U.S. wine industry as it will at harvest 2000 and is projected to continue to do for the next few years. In addition, as sales continue to grow in the premium segments, the rush for new wineries to enter the marketplace is overwhelming.

Custom wine production will have a vital role to play during this capacity shortage. It removes many barriers to entry for new wineries and allows flourishing wineries to expand production during growth periods without developing additional capacity.

This flexibility allows any winery to direct its scarce capital into inventory and marketing instead of tying it up in tanks, equipment, and buildings. Why are so many wineries turning to custom crush operators to produce and/or bottle a significant amount of their inventory? Would your winery benefit from any of these services?

Origins of custom crush

Although there is no documented information about the origins of custom wine production in the U.S., the concept has flourished among larger wineries since Prohibition and has been popular with smaller wineries since the late 1970s and early 1980s.

A common practice with some of California's older wineries was to "over design" and build facilities to meet long-term goals, rather than build in increments — as growth warranted. Cost efficiencies in building, use-permit acquisition, and elsewhere made this a practical strategy. The difficulty for those early wineries, though, was paying for that excess space and capacity. Custom wine production was the answer.

Some of these wineries continue in the custom-crush business, such as Arciero Winery and Castoro Cellars on the Central Coast. Others, such as Rombauer Vineyards in Napa County and Kunde Estate Winery in Sonoma Valley, have increased production to fill their capacity and no longer offer services to new clients.

Some wineries began slowly, by offering crush and bulk storage. Eventually, as land and construction costs increased, they included barrel storage, bottling, and full production services. In the 1980s, another form of custom wine production, mobile bottling, emerged as many owners strained to justify owning a bottling line that sat idle most of the year.

Soon, some wineries began to build custom winemaking into their business plans, not just to help to pay for equipment, but as a profit center. Vinwood Cellars in Geyserville, CA, opened in the late 1980s and was one of the first wineries developed to be primarily a custom wine producer and secondarily a branded winery. There are now several companies worldwide successfully offering a wide variety of services on a custom basis, including Napa Wine Company in Napa County and Golden State Vintners, Cutler, CA.

Why custom crush?

Typical users of custom wine production fall into two distinct categories: companies that own or control all or part of their production process but choose to use custom operations (the "Haves"); and companies that don't own facilities and use custom operations either because they have no choice or because they want the flexibility that custom operations provide (the "Have Nots").

The Haves

Why would a company that already owns winery facilities use custom services? Every year, it appears, the reasons multiply.

Bottling and barrel storage

The typical smaller winery that uses some aspect of custom wine production is missing some or all of the production process. The most frequently used custom service is bottling, where either a mobile operator comes to the winery or the wine is shipped to another site.

The economics of the custom bottling choice are compelling as the costs of owning and maintaining a bottling line are significant, and the capital is better employed in other areas of the business.

The other key area where small wineries tend to under-build is barrel storage. This is one of the more profitable areas for the custom operator, so the economics of using this service are the inverse of using custom bottling. If the winery can afford to build its own barrel storage facility or add on to its existing building, and its use permit allows, this is one area of production that the winery may be better off controlling itself (see Table A).

Custom fermentation

Using a Return on Capital Employed Analysis can help a large or small winery decide whether to add additional fermentation capacity or outsource the function to a custom operator (see Table B). As with bottling and barrel storage, control, quality goals, shipping costs, location, capital availability, and long-term plans all factor into this decision. At current rates, if custom fermentation is available nearby, outsourcing will often be a better choice than expanding.

Taking a test drive

Another common reason for outsourcing various activities is the valuable opportunity for equipment experimentation. Recently, several California custom operators have installed rotary fermentors and a variety of higher-end crush and press equipment, allowing customers to experiment with production methods without purchasing the new equipment.

Before building its new winery in Sonoma County, St. Francis Winery experimented with rotary fermentation at Associated Vintage Group's Hopland crushing facility. That experience helped with purchasing decisions when fermentors were chosen for the new winery.

Even if the winery owner prefers the new method, purchase of this new equipment may still not make economic sense. The winery may continue to outsource the activity if the improved quality of the wine warrants the expense.

Quality concerns

Custom operators are frequently asked to provide services when wineries purchase fruit from vineyards far away. For the sake of wine quality, the winery may choose to juice or juice and ferment near the vineyard, rather than ship the fruit a long distance.

Occasionally, the lower cost of shipping wine versus fruit alone can significantly offset processing costs — not to mention the savings from not owning the equipment needed to crush the outsourced fruit. Many large wineries routinely outsource a percentage of production as part of their business strategy.

Complying with regulations

For wineries that already have production facilities, a common factor in the decision to outsource services is the need to comply with the regulations related to their waste water sys-

Table A — Return on asset analysis
Assessing whether to build a barrel storage facility or outsource

CAPITAL EMPLOYED	
Building cost — 5000 sq.ft. @ $40/sq.ft. (includes infrastructure)	$200,000
Miscellaneous support equipment, (*i.e.* forklift, washing equip., etc.)	$30,000
Total capital employed	**$230,000**
DIRECT EXPENSES	
Building	
Maintenance, insurance, taxes	$6,000
Annual energy costs	$3,600
Total direct expenses	$9,600
Desired annual return on asset for the building (25%)	$57,500
Total annual cost for all barrels	$67,100
Total cost/barrel/month	$3.36*

Assumptions

- 3 square feet per barrel — 1,666 per 5,000 sq.ft.
- Land is already owned and is not factored into analysis
- Standard construction
- Labor is not included in costs

* This figure represents a benchmark or breakeven price target for this decision process. In other words if your winery can secure a custom barrel storage price (or build for less) below this figure, it may make sense for you to choose to custom store your barrels rather than build your own facility. Again, several factors affect this example, including capital cost and availability, freight from the custom operation of choice, and your own direct labor costs for barrel maintenance. Typically, you can expect a custom operator will charge you more for barrel maintenance than doing it yourself would cost and, combined with the additional cost of freight, this may push you to build that building. Obviously, if you have a building already and this would be considered an expansion, you may be able to work with a custom operator and forego the building process.

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tems, water usage, and use permit. For example, in Napa County, a new winery may be restricted in how many tons of fruit it can process from non-Napa County sources. As a result of this use-permit restriction, the winery may elect to outsource production for all out-of-county fruit, thus leaving the home facility available for Napa County fruit only.

The Have Nots

Of course, some custom wine production clients choose this route because they have no facilities of their own at all. A grower may want to process unsold fruit into bulk wine. This decision may even be a planned effort to capture a higher price per ton when the bulk market is good. However, this strategy is not usually recommended unless the market is extremely predictable because of the particular varietal and/or appellation in question. Examples of how this strategy may or may not work are outlined in Tables C and D.

Although producing wine to sell on the bulk market can reap rewards, it can also be a risky and costly venture if the wine does not turn out well or if the bulk market retreats with little or no warning. In most cases, a grower is forced to rely on custom production when fruit doesn't sell or is rejected at the hopper.

Negociants

Negociants are excellent candidates for using custom operations. They are typically marketing companies that value flexibility to take advantage of shifting markets and trends over ownership. They do not want their capital tied up in bricks and mortar, preferring the ability to adjust their inventories quickly to make the next "deal."

Typically, negociants use custom operators to consolidate, blend, finish, and bottle bulk wine purchased for a particular program. As negociant companies grow and mature, they tend to diversify buying patterns and begin to enter into longer-term contracts in order to smooth out their cycles and improve the quality and consistency of their product(s).

In addition, it appears that one key strategy used by some negociants is to work with custom bottlers that have a "desirable" bottling address in order to enhance the product image.

The prevailing question for the negociant is "When does it make sense to rent or purchase a facility and bottle your own products?" For some, the answer is "Never!" Recently, however, Cecchetti Sebastiani Cellar announced that, as a result of sales growth to more than 300,000 cases per year, it will be doing its own bottling in a new facility in south Napa County.

Currently, the magic number at which it becomes most economical to switch from custom crushing is in the neighborhood of 250,000 cases per year

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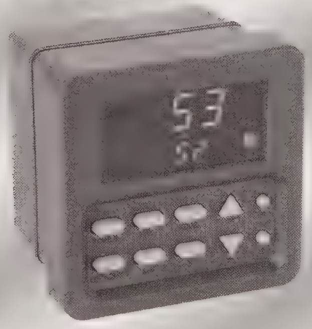

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for wineries on the North Coast where costs are greatest. This figure will be less for wineries in areas where prevailing land costs, and other costs are less.

Of course, a new wine company may also choose custom wine production for a variety of reasons. A new winery's business plan may call for the use of custom services until the winery gathers enough equity to build or buy a facility, or the winery may be faced with other constraints, such as use permits or licensing issues.

Today, many wineries that first chose custom services because they lacked facilities now appear committed to custom wine production relationships, and they give no indication of moving to facility ownership. Their wines are well-made at a reasonable and predictable price, and winery owners find that the extra capital and suffering none of the headaches that go along with facility ownership are luxuries too good to pass up.

While it may make sense for wineries of this type to eventually control all or part of their production process, their best alternative really depends on each company's goals, ownership, and capi-

Table B — Return on asset analysis
Assessing whether to buy additional fermentation capacity or outsource the production

CAPITAL EMPLOYED	
Per tank costs (1-50 ton fermentor) (includes infrastructure)	$32,000
Per tank costs (1-9000 gal. tank for drain & press)	$22,500
Total capital employed	**$54,500**
DIRECT EXPENSES	**Per tank equivalent**
Crush	
Labor	$3,920
Energy	$1,100
Interest on labor (Feb.1)	$118
Total direct expenses	$5,138
Desired annual return on asset employed per tank (25%)	$13,625
Total crush cost/tank	$18,763
Total cost/ton	$191*

Assumptions
- Two turns per tank averaging 49 tons per turn
- Fermentation tank is approximately 16,000 gallons
- Total cost of fermentation tank with all infrastructure is $2 per gallon
- Total cost for drain and press tank based on $2.50 per gallon
- 25% was assumed desired rate of return on asset
- Direct crush expenses were assumed to be $40 per ton (large winery cost)

* This figure represents a benchmark or breakeven price target for this decision process. In other words if your winery can secure a custom crush price of below $190 per ton, it may make sense for you to choose to custom crush rather than acquiring additional fermentation capacity. Again, several factors affect this example, including capital cost and availability, freight from the custom operation of choice, and your own direct costs for crush. In addition, as this example assumes fairly large tanks, you must assume a higher cost per gallon for smaller tank purchases. Obviously, if you are able to utilize your fermentors more than two times per crush season, it may make sense for you to purchase new tanks, if your permit allows for the additional growth.

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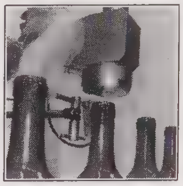

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talization structure, winemaking strategy, location and many other factors. Custom winemaking options in the future, however, may very well be different than those currently offered.

As premium wine sales flourish and grape supplies continue to rise, custom winemaking is evolving once again. Capacity formerly used by client wineries is now being filled by the successful host winery to fuel its own growth. Focused custom winemaking operations, such as Napa Wine Company, have found that they need to increase their margins through branded and/or bulk wine sales of their own — constraining their capacities for custom winemaking.

New players on the custom winemaking scene are growers who are building new facilities or buying older facilities with a different agenda in mind — they want to sell their fruit as bulk wine. Some of these growers have excess capacity and offer custom winemaking, including Bien Nacido Vineyards (Central Coast Wine Warehouse; Santa Maria, CA), Kautz Vineyards (Bear Creek Winery; Lodi, CA), Yountmill Vineyards (Napa Wine Company; Rutherford, CA), Rivercrest Vineyards (Ripon, CA), and Michael Hat Farming/Capello Winery (McFarland, CA). As a result of this shift in the capacity supply and demand chain, we are now seeing a serious shift upward in processing prices — not only in the North Coast of California, but also in the interior valley. As county governments further constrain growth and the issuing of new use permits, custom winemaking options will not likely improve until we experience another wine sales downturn and the cycle begins again. ■

Tary Salinger is owner of a newly formed wine industry consulting firm — Salinger & Associates — located in St. Helena, CA. Salinger & Associates specializes in winery and vineyard start-ups, strategic planning, brand development, custom winemaking, winery business plan development and evaluation, overall project management and creative business solutions. Salinger can be contacted regarding this article or business opportunities at 707/968-0733 or e-mail tsalinger@aol.com.

From a presentation to the 1999 CPA Education Foundation Wine Industry Conference in December 1999 in Rohnert Park, CA.

Table C — Financial analysis of grower example with unsold fruit

Dist. 11 (Lodi Area) 1998 Cabernet Sauvignon
(assumes 170 gal/ton yield).

	Sell Grapes	Produce & sell wine
REVENUE		
Dist. 11 weighted avg.	$804	
$8/gal sales price		$1360
EXPENSES		
Harvesting cost per ton (All hand picked)	$125	$125
Processing costs per ton		$250*
Bulk storage per ton (Sold by January 1)		$42
$.06/gal/month after December 1		$27
Bulk sales commissions (2%)		
NET RETURN PER TON	$679	$916

* This is an example of a mid-range North Coast custom crush charge. (As North Coast processors can accept smaller lots, many valley growers choose to truck their grapes to the North Coast for processing, though it is more expensive.) Processors in District 11 would range, depending on client volume, from a low of $85 per ton to a high of $200 per ton. In either event, depending on the grower's contracts, long term goals, etc., this demonstrates when a grower may choose to process rather than sell as fruit.

Notes:
Several factors could affect this example positively or negatively — including, but not limited to the quality of the wine, holding time, the bulk market, supply of this varietal, etc. All figures have been converted to dollars per ton.

Table D — Financial analysis of grower example with unsold fruit

Dist. 3 (Sonoma County) 1998 Chardonnay
(assumes 170 gal/ton yield).

	Sell Grapes	Produce & sell wine
REVENUE		
Dist.3 1998 weighted average price	$1,747	$2,125
Estimated bulk value — $12.50/gal.		
EXPENSES	$125	$125
Harvesting cost per ton		
Processing costs per ton		$250*
Bulk storage per ton (Sold by January 1) $.06/gal/month after December 1		$42
Commissions (2%)		$43
NET RETURN PER TON	$1,622	$1,666

* This is an example of a mid-range North Coast custom crush charge. Depending on the grower's contracts, long-term goals, etc., this demonstrates when a grower may choose to sell his fruit rather than risk going to wine.

Notes:
Several factors could affect this example positively or negatively — including, but not limited to the quality of the wine, holding time, the bulk market, supply of this varietal, etc. All figures have been converted to dollars per ton.

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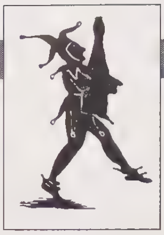

by Jake Lorenzo

Tribute

Nowadays, million-dollar winery showplaces are a dime a dozen. In 1955, there was only one. Owned by Ambassador James Zellerbach and named after his wife, Hanna, Hanzell Winery was the first crown jewel of California wine. Sitting atop the southernmost point of the mountain range that forms the eastern wall of Sonoma Valley, Hanzell offers visitors breathtaking views of Sonoma Valley that stretch all the way to San Francisco Bay.

Hanzell has always been a magical place. Ambassador Zellerbach, a prime architect of the Marshall Plan after World War II, wanted to make wines that would compete with the finest French Burgundies. He purchased his property in Sonoma, and Italian immigrants living in San Francisco insisted on coming up to plant his vineyards, as a way of thanking him for his support after the war. Talk about good karma.

Ambassador Zellerbach hired 32-year-old Brad Webb to be his first winemaker. Webb had some previous experience making wine and vermouth at Gallo, but more than anything, Webb wanted to make wine using the scientific method.

He remembered that first interview with Zellerbach, "I kept going over and over the point that I wanted to make wine using the scientific method. I wasn't interested in racking by the light of the moon, although people were making good wines that way, but I was interested in the scientific approach. I kept pounding that point."

Finally, Zellerbach said, "Mr. Webb, I've gotten your point very clearly. I employ many chemists in my paper business. I know exactly how they work, and that's the way I want us to go about making our wine."

Webb got the job all right, and a good thing for the California wine business. Brad's "scientific approach" made Hanzell the first winery to use stainless steel tanks and French oak barrels. He developed inert gas technology, using nitrogen to prevent oxidation. Brad discovered the secret to malolactic fermentation was getting the inoculation into juice, instead of wine, and he determined the best way to culture the organisms.

Brad was a scientist through and through, "I just can't understand why you should not operate knowing what you're doing, especially if it's something you can quantify. I think if you're not doing anything else, you should be measuring something. It's silly when you *can* control some variable, not to control it."

As Brad got older, and his battles with Parkinson's Disease got fiercer, he even invented a machine he called the Twitchometer. He would take the medicines prescribed by his doctors, and then measure their effects on his shaking with the machine. Then he would present his meticulous notes to his doctors.

Webb was an honorable man. He felt a sense of indebtedness to this country, and was a member of the Air Force Reserve for most of his life. He raised a family. He helped found an entire industry. He gave of himself freely and often. Brad told me he sometimes felt guilty working as a winemaker. "Yeast works 168 hours a week, and I only work 50 to 60 hours per week. It seems the least a winemaker could do would be to work as hard as the yeast."

* * *

Certain people are special. There's no other word for it. Somehow you just feel better knowing they're around, even if you don't see them very often. Molly Sessions was like that for me. Molly's husband Bob is Hanzell's winemaker today.

More than anything, Molly made me laugh. I never had the sense that Molly was trying to be funny, but she had that ability to describe everyday things in such extraordinary ways that I couldn't help but laugh. Molly could always cut to the chase, you just never were quite sure who was chasing whom.

In the old days, when there were less than a dozen wineries in Sonoma Valley, we'd have these horrible business meetings. Various winery owners would get in a lather about some serious issue. Debate would rage. Accusations and counter charges would fly.

Just when things would start to get out of control, Molly would say something to Bob or to me, (because I always tried to sit next to Molly), and we would both start laughing out loud so uncontrollably that the debate would disappear. Molly Sessions was like a corkscrew for bottles of goodwill.

Molly never succumbed to the celebrity of the wine business. She knew the business too well. For a quarter century, she worked beside her husband running the business of Hanzell Winery. She knew about the broken pumps, the dead tractor motors, the sore backs from lifting barrels, and the dead ache of exhaustion. Hundreds, even thousands of times, she poured Hanzell wines across a table, and listened to taster's comments. Never once, did I hear her complain or put on airs.

She had that deep wisdom that comes with common sense, and while I didn't always understand what Molly was trying to tell me, I never left an encounter without feeling better for it.

Brad Webb and Molly Sessions died within five months of each other; Brad in September as harvest started, Molly in January having seen the year 2000.

The first crown jewel of California is in serious mourning. Brad and Molly have enriched the lives of countless people. Jake Lorenzo hopes you, too, were among them. ■

Five-step irrigation schedule

continued from page 52

smaller berries with a larger proportion of skin compared to later moderate water stress.[9, 15, 21] Smaller berries have the potential for greater concentration of compounds that produce flavor and color in wine. However, the production of adequate foliage must always be the first priority because without it, fruit will fail to ripen.

It may not be possible to impose water stress where the soil is deep and contains large amounts of clay or when spring rains are frequent. In the instances given below, imposing water stress may have detrimental effects on fruit production and quality.[1,3,7,9]

Low vigor vineyards may require most of the growing season to produce sufficient canopy, in which case steps #3 and #4 in the above strategy are omitted. Also, vineyards with a drought-sensitive variety such as Merlot or rootstocks will need to be managed differently than described above and may not be suitable for RDI.

The author gratefully acknowledges Lynne Roberts, Greg Berg, and John Duarte for their assistance in preparation of this text.

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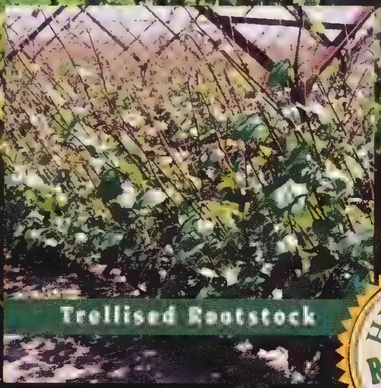

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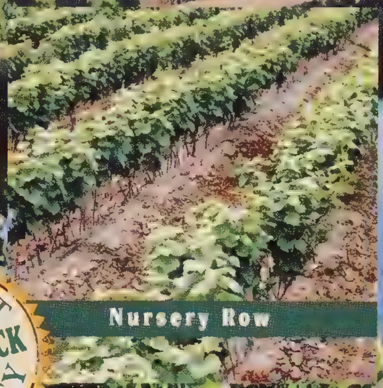

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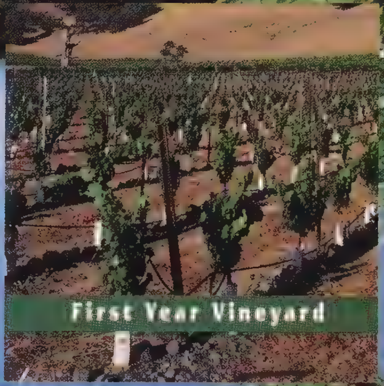

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CAL OSHA ergonomics standard: What does it mean for vineyard employers?

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California became the first state in the nation to implement regulation targeting ergonomics risk factors and repetitive motion injuries in 1997. The Cal/OSHA standard (GISO 5110, Repetitive Motion Injuries) became effective on July 3, 1997.

This regulation says that if two or more workers performing the same tasks have had diagnosed repetitive motion injuries (RMIs) in your workplace within the past 12 months, you must implement the three-step ergonomics program prescribed in the standard.

The program consists of 1) conducting a worksite evaluation for exposures causing RMIs; 2) taking steps to control exposures that have caused RMIs; and 3) implementing a training program that explains what RMIs are and the steps you are taking to control them. (This is a summary, see GISO 5110 for a complete statement of requirements.)

Is there a problem?

You might think from the popular news coverage that most jobs at risk for RMIs are related to manufacturing or clerical work. However, many jobs in agricultural workplaces have been found to involve the known risk factors and often have a very high incidence of RMIs.

The standard itself, as well as an updated history of litigation to date, is available on the Department of Industrial Relations (DIR) website, *www.dir.ca.gov*. Once there, click "Occupational Safety and Health," then "Occupational Safety and Health Standards Board," and then "Ergonomics Standard Status."

A team from the UC Agricultural Ergonomics Research Center has been investigating jobs in winegrape vineyard work (1997–1999). The UC team has worked with four Napa and Sonoma county vineyard operations and has focused on operations employing hand harvest. The results to date suggest that certain vineyard jobs create substantial risk for RMIs. In addition, the team found a high incidence of reported symptoms of RMIs.

While employers may not see many RMIs on their injury reports at this time, that may be due to worker outmigration. UC researchers suggest that because the winegrape workforce is trending toward stabilization, there is reason to believe that vineyard employers will see increasing numbers of RMIs in the future.

Before you start looking for a special consultant, some basic information and action on your part can go a long way toward improving your situation.

What is Ergonomics?

Ergonomics is the study of the "fit" between the physiology of the human body and the tasks it is asked to perform. Because of the way the body is built, it does some things efficiently and well, and others only with difficulty and stress.

Functions our bodies do not do well or do with stress are classified as "ergonomics risk factors" by ergonomists. Some of these include awkward postures (such as extreme forward bending or stooping), lifting and carrying heavy loads, and highly repetitive motions (such as pruning or harvesting).

These risk factors have been associated with the development of chronic injuries involving skeletal and soft tissues known as musculoskeletal disorders (MSDs) or repetitive motion injuries (RMIs). These injuries may affect muscles, tendons, joints, nerves and related soft tissues anywhere in the body. The lower back and upper extremities, including the neck and shoulders, are the most common sites. They are among the most frequently occurring and most costly of all workplace injuries.

Ergonomics risk factors in California winegrape production

According to an AgSafe study, California vineyard workers reported an overall non-fatal injury rate of about 4.3 per 100 workers per year in the 1981–1990 period. (AgSafe is a nonprofit professional organization for persons interested in or working on safety issues in agriculture. For information, see their website: *www.agsafe.org* or call: 559-278-4404.) This is well above the average reported for other California workers of 3.5 per 100 workers. Of these reported injuries, 42% were sprains and strains (of which nearly half were back injuries). Overexertion was cited as a cause for some 23% overall. Together, these two factors indicate the presence of ergonomics risks.

The UC Agricultural Ergonomics Research Center team found significant evidence of MSDs in reviewing health records of three vineyard operations. They reviewed records for three vineyard operators representing 194 permanent vineyard workers. Records were available for 2½ years for two vineyards and for 1½ years for one. In Table I, 29 MSDs were defined for 28 employees. These MSDs represented 435 lost workdays. This suggests an incidence rate of 80 per 1,000 workers.

In Table I, back injury is the most frequent MSD, and lifting during harvest and tractor/equipment is the most frequently reported cause.

The high proportion of back injuries suggests that jobs involving repetitive heavy lifting and bending and stooping are involved. No surprise then, that hand harvest shows up most often among reported causes.

The high proportion of these chronic injuries associated with tractors and equipment is harder to explain. The research team thinks it may be due to a combination of factors. Tractor operators are often more senior crew members who worked heavier jobs earlier in their careers.

Table I
Reported MSDs among vineyard cooperators

Body Part	#	Reported Cause	#
Back	20	Lifting (harvest)	6
Neck/Shoulder	3	Tractor/Equipment	6
Hand/Arm	3	Staking	3
Lower Ext.	3	Pruning	3
		Suckering	2
		All Other	8

Full-time equipment operators may be more subject to back injury because their muscles become less work hardened, meaning that the strain of hitching equipment, jumping to the ground, or even making long, awkward reaches can result in injury. While this suggested cause is still theory, it does warrant examining self-hitching equipment and conditioning for full-time drivers.

Evaluating vineyard jobs

Vineyard jobs were also screened for the presence of ergonomics risk factors. This was done with a checklist which assigns a numerical value to observed risk factors. Results are in Table II and clearly show that harvest jobs demonstrate the most severe ergonomic risk exposures in vineyard work.

Table II
Ergonomic risk factors in vineyard jobs

Job	Checklist score
Harvest	25
Hoeing/Weeding	19
Cutting Heads	17.6
Pruning	17.3
Pre-Pruning	16.6
Staking	15.2
Planting	15

In order to better understand workers' exposures to these risk factors, supervisors were asked to estimate the numbers of workers performing specific jobs and the duration of the job task in the vineyard. Results are shown in Table III.

When the team looked for jobs that scored high on all lists, the jobs identified as having the greatest potential risk for MSD incidence were: harvest

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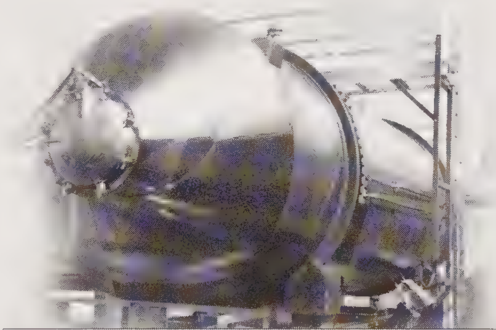

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work, pruning, and weeding (especially with shovels). These jobs were re-evaluated to describe the specific risk factors that should have priority concern for prevention planning.

Table III
Vineyard job risk exposure

Task	% of Workforce	Duration
Harvest	90+%	6–8 weeks
Pruning	50–90%	8–10 weeks
Hand Weeding	50%	Seasonal
Tractor Drivers	18%	Seasonal
Staking	10–20%	Occasional

A. Hand harvest risk factors

1. Highly repetitive handgrip to cut grapes, average 25 to 50 cuts per minute depending on grape variety and yield density.

2. Exertion of high force (up to 80 lbs) to lift and carry full tubs. Accelerative force is required to lift and dump the tubs.

3. There are multiple awkward postures involved in the harvest task, including: shoulders and forearms to reach and cut grapes; forward bending of the trunk during cutting, full stoop to gather fallen grapes and pick up tubs; forward bending of the neck to see grapes for cutting.

4. There is very high energy expenditure as the task is physically demanding (up to 52.7% of total aerobic capacity).

5. There are long carries with heavy loads to put grapes in bins for transport.

B. Pruning risk factors

1. Very high rate of repetitive cutting (36+ per min).

2. Moderate force exertion to make cuts with hand shear (estimated 30 lbs).

3. Awkward postures include: shoulder reaches and twisting of forearm and wrist to make cuts; use of pinch grip to hold vine for cutting; and sustained moderate forward bending of the trunk and neck to make cuts.

C. Hand weeding risk factors

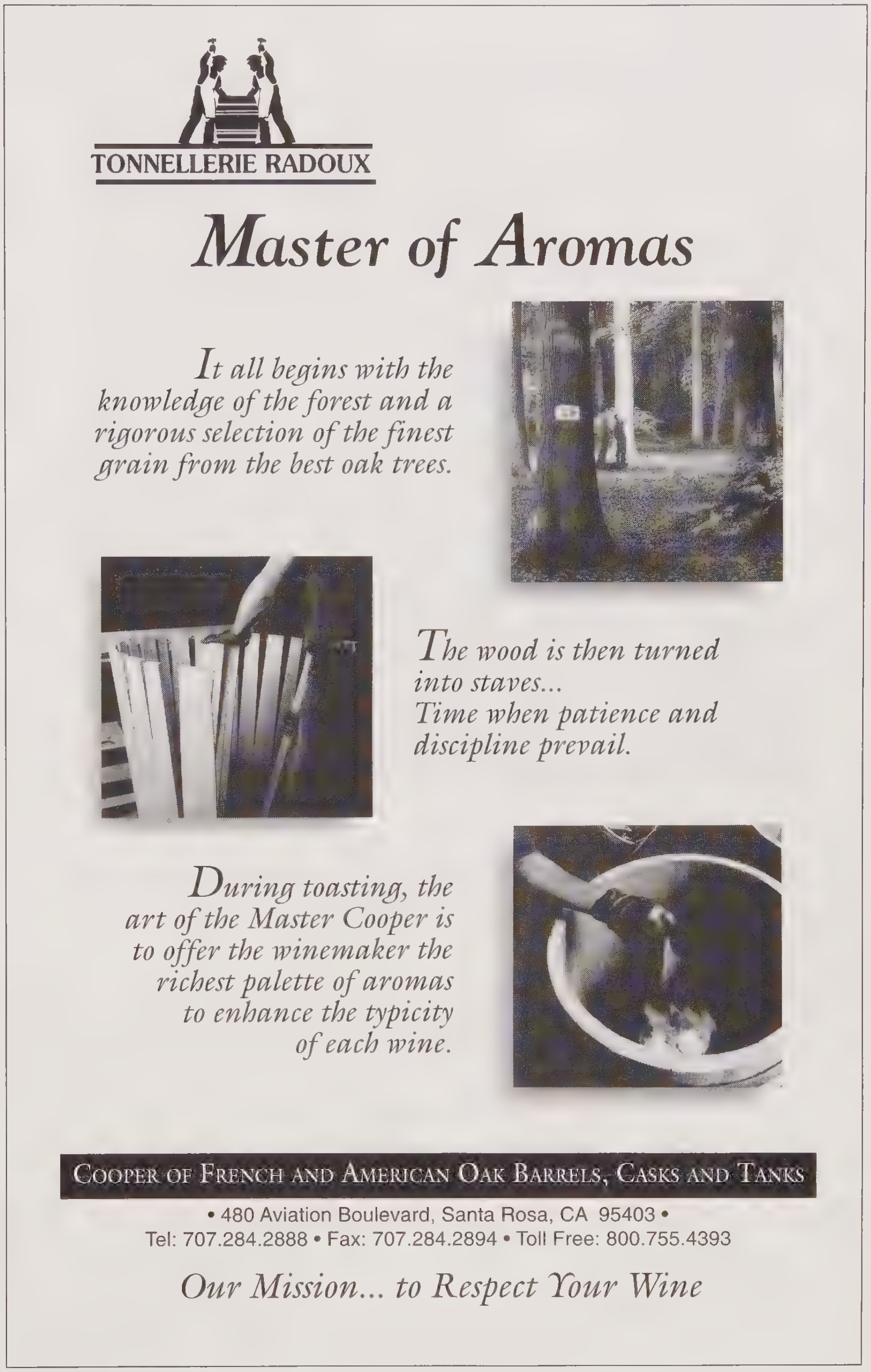
1. Very highly repetitive reaching and cutting motions with arms and upper body (50 to 60 per minute).

2. Awkward postures include: severe forward bending and twisting of upper body to make cuts and effective backward bending of neck relative to body posture.

3. Moderate forceful exertions by shoulder and arm are required to make cuts.

What to do about it?

The UC research team has completed trials with vineyard operators focusing on the use of lighter picking tubs for harvest and powered shears for pruning. Data are being tabulated, and results will be reported in a future report. The engineering group has also investigated a wide variety of hand-weeding tools, although so far without finding any to recommend highly.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Winegrape vineyard employers can get ahead of the problem of RMIs and implementation of the CAL OSHA ergonomics standard by taking some of the steps reported here. First, review your vineyard's OSHA Log 200 and first aid records to see if any reported RMIs can be associated with specific jobs. RMIs may be described by some of the following terms:

- tendinitis (inflammation of a tendon),
- bursitis (inflammation of the sack surrounding a joint),
- carpal tunnel syndrome (pinched median nerve at the wrist),
- cubital tunnel syndrome (pinched ulnar nerve at the elbow) and,
- myalgia or muscle pain, which may also be referred to as muscle strain, tension neck, or neck and shoulder syndrome.

Also consider jobs associated with high incidence of sprain/strain injuries. Developing RMIs are often diagnosed as sprains or strains. This will give you a list of jobs you should consider as potential priorities for preventive action of some kind. Both you and your workers can begin to think about changes that might help and prove practical. Remember, if you have two or more RMIs reported for workers in the same job in a 12-month period, you are subject to the Cal/OSHA RMI standard.

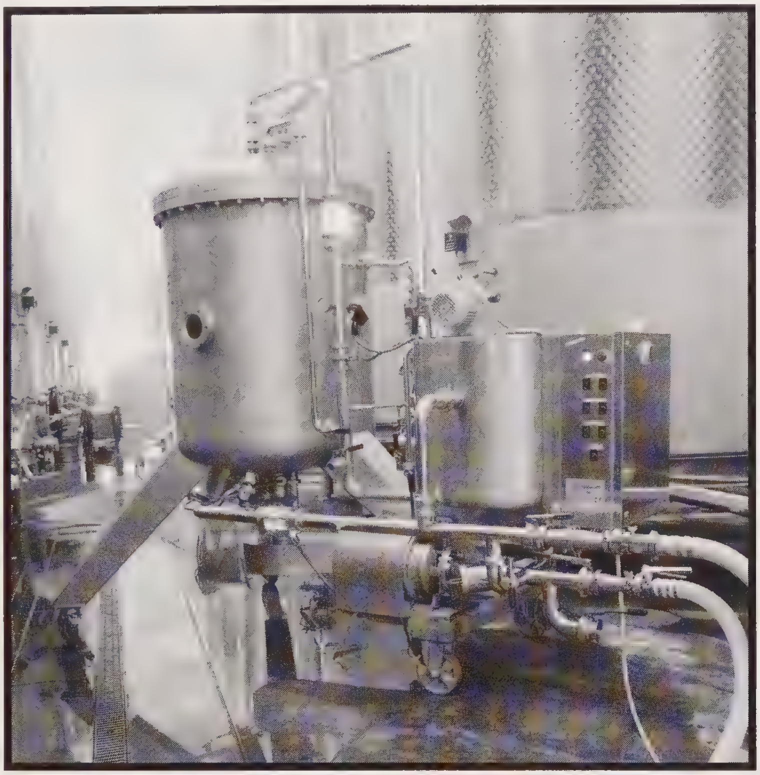
Repetitive Motion Injuries standard

Employers subject to the RMI standard must implement an ergonomics program. In addition to identifying the jobs associated with RMIs, you must: 1) evaluate those jobs for ergonomics risk factors, 2) undertake some corrective action to control or reduce worker risk factor exposures involved, and 3) implement a worker training program. NOTE: The standard exempts employers with fewer than 10 workers.

Being subject to the standard requires that you also evaluate the jobs for ergonomics risk factors. The UC team has developed a very simple one-page check sheet for doing this, which is included in the UC Agricultural Research Center's pamphlet titled, "Ergonomics Programs in Agricultural Operations," (available free from the UC Agricultural Ergonomics Research Center, University of California, Davis, CA 95616). The third required element is to provide training for employees on ergonomics risk factors, repetitive motion injuries, and your ergonomics program.

The most difficult part of the RMI standard is its second element, requiring efforts to control or reduce employee risk factor exposure. However, it is through making changes in tools or job practices that these injuries can be successfully prevented.

Continued on page 92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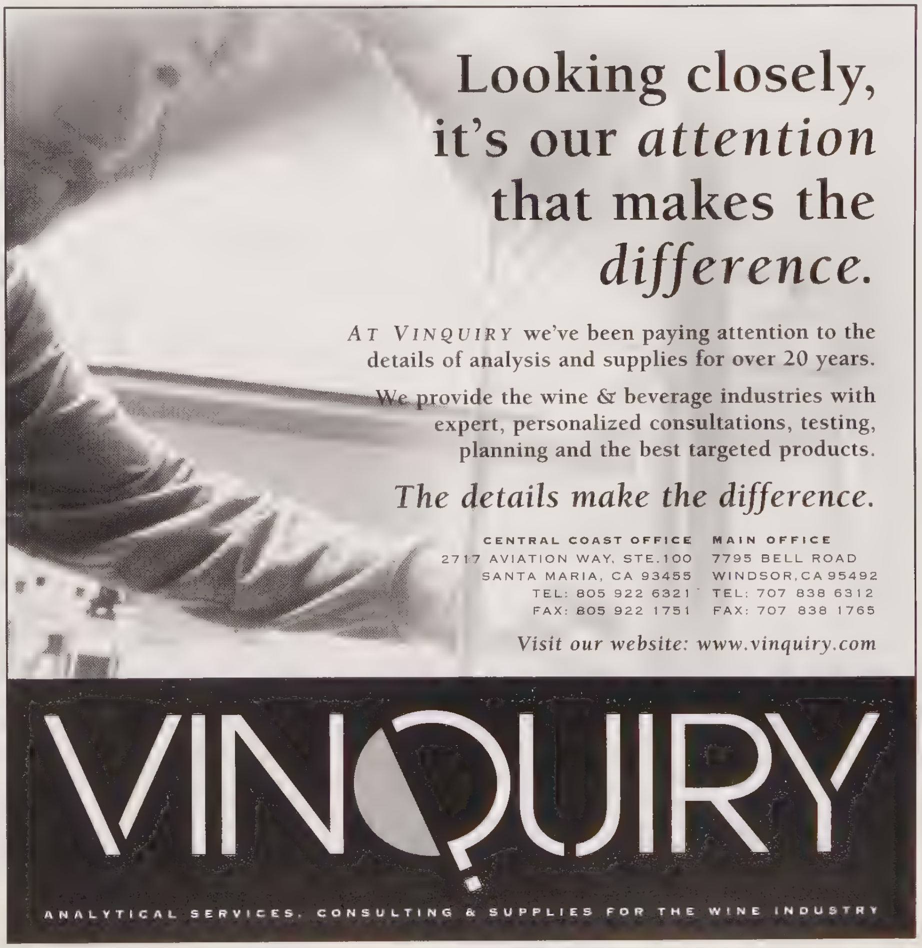
PLEASE SEE THE WORLD COOPERAGE ADS, PAGES 2, 48 & 49.



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REALITY BITES

NEW FOODS CALL FOR NEW WINES

BY Randal Caparoso
Roy's Restaurants
Honolulu, HI

Just over the cusp of the 21st century, we find ourselves nearly overwhelmed with choices in food and wine. Recent Rockefeller University research estimated that about 500 foodstuffs were available to the average American 100 years ago; today there are more than 50,000. From a handful of wines, there are now thousands available at any given time, in any given store or restaurant.

Globally-sourced foods and wines are not merely accessible, but also sold in every price range, from everyday affordable to insanely expensive. Gastronomy in general has become sexier; and as with anything projecting such raw mass appeal, it has become big business.

But the sorry fact about the foods and wines that we now consume is that they have not necessarily become more compatible. In fact, 50 to 100 years ago the matches were probably easier. Chablis with oysters, Hock with ham, Chianti with marinara, Bordeaux or Zinfandel-based "Claret" with steak — simple, effective, and as the French would say, *a priori*. You don't have to think about it to know it works.

But what of today's dishes? Consider the salad. All the old books say the same thing: Skip the wine with salad, because neither wine nor vinegar does the other any good. Well, today many of our meals are salads. Gee whiz, no wine?

What about the thousands of customers who enjoy Roy Yamaguchi's (chef/owner at Roy's Restaurants) wilted spinach and bitter mesclun salad with pungent sweet onions, plump beefsteak tomatoes, and crispy cubes of pancetta in a warm balsamic vinaigrette, and then rush home to make it for themselves?

Chef Jean-Georges Vongerichten (Jean-Georges, New York, NY) wows throngs of people with boiled potatoes and frisee with chunks of gorgonzola in a honey-garlic vinaigrette. A recent cover of *Food & Wine* makes us salivate with "Big Sky Nicoise" made up of smoked trout, capers, cherry tomatoes, olives, and hard boiled eggs in a stone-mustard, white wine vinaigrette. Positively inspiring, but how do the Chablis, Hock, Chianti, and Claret fit in? At first glance, with much difficulty.

Such a predicament. Or is it? The reality is that people will make salad meals with a myriad of components, and if they do what all of us in the restaurant, grocery, and winemaking industries truly wish them to do, they will drink wine with them.

So the logical thing for all of us to say is this: "Never mind what the books and gastronomes have told us in the past — go ahead and enjoy wine with your salad."

Sweet onions, tomatoes, and warmed balsamic vinegar, for instance, respond fairly well to a fruity Rosé or Vin Gris of Pinot Noir from California or Marsannay. Sharp/salty Gorgonzola goes as well with a honeyed vinaigrette as a honeyed, medium sweet/sharp Mosel Riesling Halbtrocken.

What about smoked trout, capers, eggs, olives, and mesclun? No problemo — flinty dry, zesty, lavender and flower-scented Spanish Albarino. The reason these combinations work is that the slightly elevated acidity in the wines binds easily with vinaigrettes and is amplified by the interaction of multiple food ingredients and taste factors, such as sugar, spice, *terroir*, and texture, in the wines.

The global sourcing of foods, in other words, has begotten a global mentality toward food/wine matching. The only hitch — pink Marsannay, Riesling Halbtrocken, and Albarino are just not as easily sourced as Chardonnay and White Zinfandel.

The Internet may be an amazing new source of information, but one click of a mouse is hardly likely to give consumers the precise match for the wildly varied and imaginative menus that any number of our new fangled restaurant or food magazine chefs are dreaming up as we speak.

If anything, the food/wine advice dispensed on websites is not much more sophisticated than Chablis with oysters and Chianti with marinara. Why? Because there are very few wine writers qualified to explain the complexities of today's foods, let alone in precise respect to the enormous range of wines now at our disposal.

Recent food/wine gurus such as Tim Hanni (Napa, CA) have at least put tremendous energy into training chefs to produce foods that are compatible with the standard range of commercially available wines — Cabernet Sauvignon, Chardonnay, Sauvignon Blanc, White Zinfandel, and, when especially daring, Gamay Beaujolais. But do you think that today's chefs — or home cooks, for that matter — give a hoot about whether or not their dishes will go with such wines? Dream on. Because reality, as they say, bites. And here's what it's telling us:

1. Consumer knowledge and use of varied foodstuffs are growing at a far faster pace than their knowledge and use of "alternative" wine types (such as the Marsannays, Albarinos, and Mosel-Saar-Ruwer Rieslings of the world).

2. Standard commercial-style wines — generally designed to entice and flatter the palate outside the context of food — are becoming woefully inadequate to the task of matching

even a partial range of today's preferred food types.

If anything, many of us in the restaurant business have become impatient with the obliviousness of the wine industry — not just in the U.S., but also internationally — to what we perceive as the common factor in all established wine cultures: wines are designed primarily with food in mind.

Sure, a consumer purchases a certain brand of Cabernet Sauvignon because of its aromatic richness, a Chardonnay because of its "buttery" texture, or a Riesling because its sugar/acid balance flows smoothly across the palate. But average consumers have a meal in mind before they consider the wine. Even for the most hardened aficionados, who may indeed consume much wine for the sake of consuming wine, the ideal situation is invariably wine with some kind of great meal!

This is why I find it amazing that rather than making wines to fit in with this new world of variant food types, most vintners continue to focus on more insular goals such as varietal character, regional distinction, industrial strength extract, market positioning, brand identification — almost everything but the consumers' most basic need, which is food compatibility. What a shame!

After founding our own family of Roy's restaurants in Hawaii (1988), we quickly became frustrated with the process of searching out the ideal wines to fit our own stronger, Asian style of cooking — meaning, aggressive juxtapositions of sweet, sour, hot, bitter, and yes, umami-related sensations.

Not only that, but we were also looking for wines with both reasonable price points and a little more recognizable identity than, say, Bruno Clair Marsannay, Lusco Albarino, and Forstmeister Geltz Zilliken Saarburger Rausch Riesling Kabinett. The market's more familiar range of Chardonnay, Sauvignon Blanc, Cabernet Sauvignon, Merlot, and Pinot Noir styles have simply not sufficed.

Our solution at Roy's? What we did was seek out the most open-minded and food-conscious winemakers and enlist them to customize their Chardonnays, Cabernets, Pinot varietals, and others to match our food, price, and merchandising needs.

At the moment, part of our lineup of willing partners includes Au Bon Climat's (Santa Maria, CA) Jim Clendenen, Rex Hill's (Newberg, OR) Lynn Penner-Ash, Laurel Glen's (Glen Ellen, CA) Patrick Campbell, Iron Horse's (Sebastopol, CA) Forrest Tancer, Italy's Riccardo Cotarella, and Germany's Dr. von Bassermann-Jordan. All this talent, of course, is fine and dandy, but exactly what did these vintners do to increase compatibility with Roy's Euro-Asian style food? To wit:

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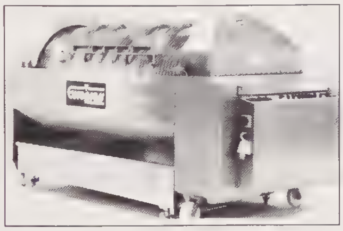

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- Since we believe that Chardonnay should be rich and dense, yet not so big and fat that it smothers food like a mattress on a cork, we ask Clendenen to craft a more supple, intrinsically crisp and moderately weighted style of Chardonnay — one that can handle white wine butter sauces spiked with everything from Chinese, Japanese, and Southwest chili spices, to ginger, uni, and roasted peppers.

- Since we like the versatility of Pinot Noir with both our fish and low-fat meats in spicy sauces, we ask Penner-Ash to fashion one with crisper acidity and moderate tannin, while maintaining the classic silk and pronounced varietal spiciness.

- Since we want our Pinot Gris acidic enough to be enjoyed with appetizers in exotic vinaigrettes, yet creamy enough for French-style butter sauces, we ask Penner-Ash to barrel ferment our Oregon-grown Pinot Gris in older French oak to achieve a creamy texture without the tannin or obvious flavor of oak.

- Since we think that even California-style *methode Champenoise* Blanc de Blancs can be too sharp and lean to actually drink throughout a meal, we select Tancer's older cuvées (five to six years *en tirage*) with more pronounced length, creaminess, and yeastiness, and we round out the acidity with slightly sweeter dosages laced with crisp, still Chardonnay.

- We love the lush fruitiness and soft, pliant tannin in Umbria-grown Merlot, but to create a little more sense of volume and trace of smokiness to bring the wine from a drink-alone to grilled meat context, we ask Cotarella to age the Roy's Merlot Umbria in one- and two-year-old French oak.

- We believe that powerful, thick Cabernet Sauvignon can also be perfectly round and fleshy — which is what you need for grilled meats in highly reduced, Asian spice and sometimes fruit-infused natural sauces. Patrick Campbell achieves this objective by building broadly textured Napa Valley-grown fruit around a core of concentrated, black fruit-toned Sonoma Mountain-grown Cabernet.

- In Germany, we stick to a brightly acidic, slightly sweet (25 to 29 grams residual sugar) and markedly *minerally* selection of Riesling from a noble vineyard — the Deidesheimer Leinhole — to match the flint and salinity of shellfish, the flaky delicacy of Hawaiian deep sea fish, fresh tropical fruit vinaigrettes, and Asian chili-spiced salads and appetizers.

The bottom line is that we are bringing in perfectly delicious and complex wines, while also making decisions easier for our customers by building in food compatibility and maximizing the overall experience in the process. Isn't that what selling food and wine is all about? I only wish it was made easier by an even wider range of commercially food-worthy wines available to choose from.

From our own perspective, the future of fine wine is really in its past. If you examine the oldest wine cultures — such as France, Italy, and Spain — you find that they didn't grow out of the pens of writers like Robert Parker and were certainly never driven by ratings, advertising, and marketing schemes. Instead, they grew on the strength of seemingly natural compatibilities — as if certain wines were always meant to go with certain foods. And you can bet that this centuries-long process primarily involved wines evolving to match with foods, rather than the reverse.

The only difference between the past and present is the current tumultuous circumstances.

Our taste in food is evolving much faster than it did in the past, so too must our wines. Once things even out, maybe we can all sit back and enjoy the fruits of that long-awaited Jeffersonian dream of a "wine drinking nation." ■

PWV's newest regular contributor, Randal Caparoso (caparosor001@hawaii.rr.com) has been a partner, vice president, and corporate wine buyer for Roy's restaurants since their founding in 1988. Other recent stories by Caparoso can be found at www.wine-lovers-page.com/randysworld.

Balancing Yield and Quality

continued from page 19

is not a positive; the vine needs to get enough moisture. I work with a property on Diamond Mountain in Napa Valley, growing Cabernet family grapes, that has dry, volcanic tuffa (a soil low in nutrients and organic matter). If vines get stressed due to lack of water, they will just stop — start to drop leaves, and the fruit will shrivel up.

"We have improved wine quality on that property by making sure that those vines do have sufficient irrigation to make sure that they don't stress, don't shut down, and don't ripen too quickly. We saw that in the 1976 Burgundies — a drought year — the Côte de Beaune didn't make wine as good as the Côte de Nuits, which got more rain. We are still trying to understand it, and nobody has the answer as to when and how much water deficit is appropriate."

Conclusion

Modern grapegrowing is benefitting from a growing depth of experience that is leading some growers and vintners to question some so-called "truths" about what produces quality grapes and wine.

New World growers, particularly in California, have come to recognize that yield is not the sole, or even most important, arbiter of quality, and that vine age doesn't necessarily dictate wine quality. They are reconsidering vineyard densities, and more are using irrigation as a tool to assure wine quality.

Growers in France and on the west coast of the U.S. are dissatisfied with the rough measure of yield that is produced by measures of hectoliter per hectare or tons per acre, depending instead on the measure of yield per-vine to help them produce quality grapes. ■

LETTER TO THE EDITOR

Dear Editor:

The article "Oak Root Fungus on Grapevines" in the March/April 2000 *PWV* was very informative, but I found it much too pessimistic on spot treatment. In 1972, my parents replaced a walnut orchard with own-rooted Cabernet Sauvignon. Oak root fungus symptoms appeared after a few years in two spots, and my mother recalled that the walnut trees in those two places had appeared to be infected.

After I bought the vineyard in 1978, I followed the treatment recommended by the farm advisor. First, we dug out the infected and neighboring vines with a backhoe, being careful to remove all root remnants. We planted sudan grass in the infected areas in the spring to dry out the soil. Come fall, we bored holes at three-foot spacings, dropped two small cans of methyl bromide in each hole, punctured the cans with a headless nail on a stick, quickly filled the holes with dirt and then tarped the area, being careful to seal the edges with packed dirt.

The oak root fungus did not appear after we replanted and has not appeared some 20 years later in the new vineyard we planted after phylloxera destroyed the own-rooted vines. I suspect that the authors of the article are only familiar with cases where the entire area to be planted was ripped and then fumigated. Our experience shows that a careful spot treatment after observed infection is preferable.

R. Stephen Devoto, Ph.D.
Devoto Vineyards, Kelseyville, CA

Dr. Devoto:

We appreciate your response to our article "Oak Root Fungus on Grapevines" and are glad to learn that your control efforts were successful. We did not intend to deny the efficacy of spot-fumigation with methyl-bromide in controlling Armillaria root disease on grapevines.

Our skepticism of this technique comes from actually seeing root disease on replants in vineyards where spot-fumigation was used, but, we suspect, in combination with inadequate removal of infected vines and/or under moist soil conditions.

In your vineyard, methyl-bromide likely provided permanent control because you used a backhoe to remove infected vines and were "careful to remove all root remnants." You properly diagnosed the disease, removed all infected root systems, allowed sufficient time for the soil to dry out, and applied methyl-bromide as recommended by your local farm advisor. Following is an addendum to our article:

Methyl-bromide, when used on a spot-fumigation basis, will likely provide long-term control of Armillaria root disease in vineyards if the roots of the infected vine(s) are thoroughly removed prior to application.

Spot-fumigation is accomplished by burying one or more closed 1.5-pound cans of methyl-bromide with soil after the infected vine is removed. The cans, once below-ground, are punctured by remote control. Covering the spot with a tarp, used when large areas of soil are fumigated, is not required, but usually results in better treament.

What are required, as in application of other chemical treatments, are a pest control applicator license, a permit from your local agricultural commissioner, and proper posting. Successful soil penetration depends on soil texture and dryness.

As long as the fumigant reaches remaining infected roots and the inoculum that originally infected the vine, spot-fumigation with methyl-bromide will provide long-term control of Armillaria root disease. Keep in mind, though, that methyl-bromide is being phased out and banned for use as a soil-fumigant due to its destructive effect on the ozone layer.

Thank you for your helpful comments.

Kendra Baumgartner,
David M. Rizzo,
Department of Plant Pathology,
University of California, Davis

CAL OSHA ergonomics standard

continued from page 80

For example, with highly repetitious jobs like hand harvest or pruning, the priority would be to eliminate or reduce repetitive hand work. No existing tool immediately lends itself to this in hand harvest, meaning that corrective action might involve something like frequent mini-breaks. In pruning, however, powered pruners almost completely eliminate this risk factor.

For repetitive heavy lifting, as in harvest, the priority objective would be to reduce the weight handled. For jobs involving awkward postures such as stooping to lift tubs, the priority would be to keep the loads off the ground, with a stand of some sort, for example.

Why should you be concerned about such measures if you aren't yet experiencing a high level of reported MSDs? Because they are there and developing in your workforce now. While the record of reported and diagnosed MSDs remains fairly low in many vineyard operations, this may be due to a variety of factors, including general youth of the workforce involved, worker outmigration, and workers' acceptance of the physical demands and aches and pains associated with the work. As the vineyard workforce continues to stabilize, it will also age and these injuries will begin to be recorded.

More important, by thinking the problems through, we can help workers become more efficient and less likely to suffer serious injury.

What next?

The most difficult task will be finding low-cost interventions that reduce risk factor exposures and help prevent RMIs. The research project reported here has moved to do just that with both the harvest and pruning jobs. The results of field trials of possible interventions for these jobs will be the subject of future reports. ■

This work was supported by National Institute for Occupational Safety and Health Agreement PHS-CCU912911-01.

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June 19-23, Washington State Convention & Trade Center, Seattle, WA

Enology and viticulture topics will draw on expertise of 35 researchers and scientists: Monday: sensory evaluation, grapevine cold hardiness and management; Tuesday: wine analysis, vineyard mechanization; Wednesday: wine flavor, plant materials; Thursday: wine biotechnology, vine balance; Friday: wine ageing, pest management, and an experimental design from vineyard to winery workshop.

Annual meeting begins Tuesday with presentations by Dr. Linda Bisson (UC Davis), Art Caputi (E&J Gallo Winery), Amand Kasimatis (Emeritus, UC California Coop Extension).

Dr. Jorg Rupf (St. George Spirits) gives James F. Guymon lecture/tasting on Thursday.

Supplier trade show is Tuesday and Wednesday.

Inquiries to: ASEV, tel: 530/753-3142, e-mail: society@asev.org, or www.asev.org.

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Inquiries to: Ellen Harkness, tel: 765/494-6704, Purdue University, e-mail: harkness@foodsci.purdue.edu.

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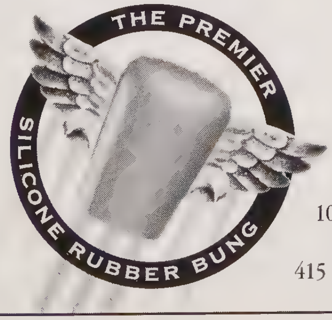

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SMART VITICULTURE

by Dr. Richard Smart

Growing young vines in tubes

One of the biggest changes in viticulture in the last decade or so has been the use of tubes around young vines in the first year of growth. The practice has caught on dramatically, especially in the U.S. and Australia. I have often seen extensive areas of vine tubes, laid out neatly in line, stretching to the horizon in all directions.

Despite the widespread adoption of vine tubes, there have been relatively few studies of the impact on growth and performance. True, there are many claims by manufacturers and salespersons, but there seems to be little hard data. Vine tube proponents claim benefits of faster growth, protection from weed sprays and animal depredation, and reduced need for vine training.

I recently had the very good fortune to attend the Viticulture 2000 Conference in Buffalo, NY, in February. What a fine meeting it was too, packed full of useful, take-home messages for growers, and so well organized. One of the best sessions I attended was on young vineyard establishment, which featured three papers on vine grow tubes. I should point out that I use the term "grow tubes" in a generic sense, not to endorse any one brand.

Importance of good growth in first year

I think one of the least studied and least understood aspects of viticulture is the care and training of young vines, and the implications of that training for future growth and productivity. Any grower with a keen sense of economics will tell you that strong growth in the first two years means high levels of early cropping, and that this has an enormous positive impact on cash flow. Moderate crops are possible in the second growing season and close to full crops in the third season.

Dr. Tom Zabadal of Michigan presented an excellent paper at the Viticulture 2000 Conference on how young vine growth is affected by weeds, irrigation, and nitrogen application. (I will cover that topic in a future column.) For now, I want to discuss the results that three speakers — including Zabadal — achieved with grow tubes. The other speakers were Dr. Bob Wample of Washington State University, Pullman, WA (and recently appointed Chair of the Department of Viticulture & Enology at California State University, Fresno, congratulations Bob!), and Kevin Ker from Ontario.

How do grow tubes work?

Wample and his team of helpers performed very extensive studies on the vine's physiological response to grow tubes. It is a widespread observation that vines grow more quickly in tubes, but why?

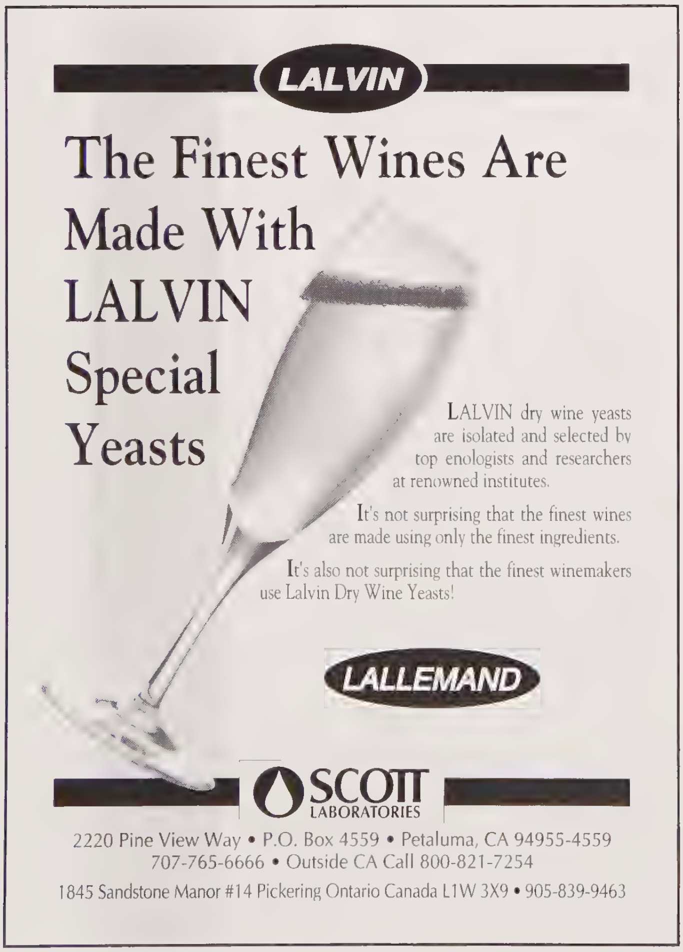
A reasonable first approach is to measure light transmitted by tubes, which is important in affecting photosynthesis. Most sunlight coming into the tubes is transmitted through the walls, since the opening at the top is soon covered by leaves once vines grow tall. Wample's team found a surprising difference in the amount of light transmitted by various tubes on the market. Green plastic tubes transmitted the most (about 80%), while others transmitted as low as 20% in the blue part of the spectrum. Cardboard tubes are opaque, and transmitted none! The lesson is that if grow tubes make vines grow faster, it is surely not because of increasing sunlight.

Since atmospheric carbon dioxide is used in photosynthesis, one might think that the tubes might enhance CO_2 levels, since some CO_2 is produced by soil organisms and becomes entrapped in the tubes. But this seemed not to be the case. There was little difference between tubes in CO_2 concentration.

Perhaps vine growth in the tubes is modified by altered temperature and humidity, since exchange with the outside atmosphere is restricted. Temperature levels are certainly increased on sunny days, up to 20°F where the tubes transmit sunlight. Milk cartons, on the other hand, produced lower temperatures by 5°F. Nighttime air temperatures in the tubes are similar to surrounding air. Temperature increases are smaller for overcast days.

The most substantial difference was in relative humidity. Outside air in the dry Washington state climate in July is a low 15% by day and up to 80% at night. Grow tubes of all types had a dramatic effect on these values. The daytime humidity in tubes was up to 90% during the day, and to 100% at night. These significant differences will have an effect on the vine's water stress, since higher humidity means less transpiration, and a potential for more growth. Measurements with a pressure bomb supported the fact that vines in grow tubes suffer less water stress.

Wample's team found that longer grow tubes encouraged faster growth, again consistent with the idea that faster vine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growth is due to higher humidity and less water stress. He also suggests that grow tubes may decrease cold hardiness because of daytime temperature increases, which has implications for time of removal in cooler climates.

The Michigan study

Zabadal found that Riesling vines grafted to 3309C rootstock initially grew more quickly in grow tubes, though the number of leaves and leaf area were reduced. Later in the season, when most of the growth had occurred outside the tube, vines with grow tubes were no taller, and leaf area and number were still reduced. Winter pruning measurements showed that pruning weight was greater for vines without tubes, and internode length smaller. February measurements of winter hardiness showed that vines within tubes were less hardy than those without.

The Ontario study

The Ontario study was done on part of a large commercial vineyard using 11 different treatments of different grow tubes, and a control. Green tubes produced more growth, as did taller tubes, and those with holes. Vines in tubes grew more quickly, with taller plants recorded at the end of the season. These tubed vines also had longer internode length, and multiple shoot growth, and lateral shoot growth was suppressed. Interestingly, the tubes increased shoot diameter.

On the negative side, vines in tubes had more mildew than those without. Kevin Ker postulates that the daytime temperature rise may have encouraged mildew development.

Conclusion

There seems to be clear evidence that grow tubes encourage initial vine growth due to elevated humidity, and this seems a clear advantage in hot, dry climates. Even in cooler and more humid climates, initial growth is encouraged.

There is also little doubt that grow tubes make weed management easier, and they can stop animal damage.

Zabadal asked the question regarding the economic benefit of grow tubes, and on this point there is more conjecture. In my opinion, any practice we can use to encourage early vine growth that quickly forms a framework for early cropping can be most beneficial, so I typically recommend grow tubes. But their benefits will obviously vary from vineyard to vineyard and region to region, and with other management practices. ■

A future column will address this most important issue of early vine training and cropping.

Dr. Richard Smart, "the flying vine-doctor" is an international viticultural consultant. Contact him in Australia by fax at 011-612-6584-0121, or by e-mail: vinedoctor@compuserve.com. Visit his home page at www.smartvit.com.au. He visits America frequently and can be contacted at Vinquiry in Windsor, CA, tel: 707/838-6312.

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by Sue Weeks

PART II

Economic benefits of Laboratory Quality Management

(or how to save your winery heaps of money)

Many wineries put off implementing a quality management system because of the perceived cost in time and money. They don't realize that, although the initial investment of time and money may be daunting, the payoff in efficiency and savings achieved far outweigh the initial cost. Other benefits also accrue — some are tangible and others a little more difficult to define.

Concern about cost is just one of the common mistaken beliefs about the quality process, that leads wineries to avoid implementing a quality system.

Myth: A mountain of paperwork and effort are required

Often, when people hear the words "implementing quality," they immediately think of mountains of paperwork with no obvious objective, and they fear additional staff will be required to cope with the extra paper. The truth is that, with a good computer system, you may not need much paper at all!

At one end of the spectrum, you can implement a quality system that enables your winery to achieve formal accreditation to an international standard. But implementing quality can also be as basic as using standards with each batch of analysis to check that the method is working.

Table I

Quality term	What it means *(in simple English)*	What it means *The formal definition
Accuracy	When the result is absolutely correct, usually when measured against a primary standard (see below)	The degree of mutual agreement between an observed value and an accepted reference value. Accuracy includes a combination of random and systematic error components, due to sampling and analytical operations.
Analysis traceability	An analysis that can be followed back through to the raw data and checked against the standards and duplicates. It generally provides evidence that the result is correct. Also applies to equipment and calibration.	The property of a result whereby it can be related to appropriate internationl or national standards through an unbroken chain of comparisons.
Approved suppliers	Those suppliers whose materials and equipment show evidence of good quality and consistency. Often they will demonstrate a quality system of their own that gives you confidence in their goods and services.	
Calibration	Making sure that the equipment is doing what it is supposed to do. Using certified weights on the balance, making sure that the volume of flasks and pipettes are accurate, that the spectrophotometer is measuring at the correct wavelength, etc.	The set of operations which establish, under specified conditions, the relationship between values indicated by a measuring instrument or system and the known values of the measurand.
Duplicates	Analysis of the same sample for the same analyte to measure precision on an ongoing basis. Sometimes performed in succession or at the end of the analysis batch. Criteria for acceptance of the batch can be based on these results.	
Equipment inventory	A list of all the laboratory equipment, where it was purchased and on what date. Handy for guarantee and warranty claims, servicing and budgeting for eventual replacement.	
Errors — Systematic	An error that occurs due to a repeatable problem. Sources of this error are usually instrumentation or reagent based.	Result of a measurement minus the mean that would result from an infinite number of measurements of the same measurand carried out under repeatability conditions minus a true value of the measurand. It is equal to error minus random error.
Errors — Random	An error that occurs when your technician is having a bad day.	Result of a measurement minus the mean that would result from an infinite number of measurements of the same measurand carried out under repeatability conditions. It is equal to error minus systematic error.
Methods	A 'recipe' for the analysis. Should include enough information so that a qualified person off the street could do the analysis.	
Precision	When the same result on the same sample is achieved more than once. Precision can be measured using the same and different operators, equipment, methods, times, and laboratories.	The degree of mutual agreement among independent measurements under specified conditions. It is expressed as standard deviation, variance, or range in either absolute or relative terms.
Primary standard	A standard which is stable at room temperature. That is to say, it will not evaporate or absorb water or anything else from the environment and easily remains in its pure form.	A standard that is designated or widely acknowledged as having the highest metrological qualities and whose value is accepted without reference to other standards of the same quality.

These, and any of the steps in between, are all steps in the right direction.

As with any large project, if you look at quality implementation as an enormous mountain of extra tasks, you will never start. However, if you take it one step at a time, you will achieve your objectives, slowly but surely. Just remember, it's important not to get buried in the small details and lose sight of the final goal.

Sometimes quality-minded people become so painfully pedantic about the fine print of quality implementation, that they lose sight of the ultimate goal — to improve the product and profitability. It's a bit like shoveling pomace. If you focussed on all the pomace that must be removed from tanks each vintage, you would have difficulty finding the strength to pick up the shovel to begin. However, if you just take it shovel by shovel, presto, harvest is over, and you have another vintage of good wine and a mountain of pomace out in the vineyard.

Myth:
More staff is required

If you are seriously considering formal accreditation at some stage, then an extra staff person probably is required to coordinate the process, if nothing else. However, if you wish to improve the quality of your analysis in small step-by-step increments, it is not necessary to employ a dedicated quality person. You can acquire the know-how to implement small quality changes from a quality consultant, a good book, or by watching this space!

Table I

Quality term	What it means *(in simple English)*	*The formal definition
Proficiency testing	Being able to get the same correct results as another laboratory doing the same test.	A means of evaluating a laboratory's performance by means of interlaboratory comparisons overseen by an external source.
Recovery	If a standard of 5g/L tartaric acid was prepared and its total acidity measured, the expected result would be 5.0g/L, or 0.5g/100mL. If the result is 0.45g/100mL, the recovery is only 90%. If the result is 0.55g/100mL, then the recovery is 105%. Most methods will have an acceptance criteria for recovery, so that the analysis is repeated if the recovery does not fall within a specified range. This range varies for different analyses, based on method variability or client expectations.	The amount of a spike or standard recovered during the analysis.
Repeatability	A type of precision	Type of precision relating to measurements made under repeatable conditions, including the same method, same material, same analyst, same laboratory, and within a narrow time period.
Reproducibility	Also a type of precision	Type of precision relating to measurements made under reproducability conditions, including the same method, different analysts, different laboratories, different equipment, and over a long period of time.
Spikes	Making additions to a sample to ensure that there is no interference from compounds within the wine. For example, a series of additions of tartaric acid (0, 1, 2, 4g/L) is made to a wine sample. If the initial result (control) measures 5.0g/L the others should read 6.0, 7.0, and 9.0g/L respectively. If they don't, it is possible that there is interference. Of course, this is the case only if the balance used to weigh the acid addition was accurate (see traceability)!	A known mass of target analyte added to a blank or a sample to determine recovery efficiency or matrix interferences. Using material from a source other than that used for the calibration standards is an excellent means of verifying a calibration and method performance.
Standard additions	Another term for spikes	
Standardization	Determining the exact molarity of the titrants or other critical reagents so that the correct factor is used when calculating the results.	
Training Records	A list of what the laboratory staff can do. Helpful for planning staff development and finding out who can do what when staff are on leave or ill.	
Validation	Ensuring that the method works in your environment. Preparing spikes (or standard additions) for all the different matrices (usually, red and white wine, red and white juice, late harvest or fortified products) over the whole range of expected results to ensure that the method works.	The confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled. The uncertainty of the result, detection and quantitation limits, selectivity, linearity, robustness against external influences, and matrix interferences should be assessed during validation of a method.

Myth:
It takes too much time

Quality management doesn't have to take a lot of time. Quality is another form of common sense and most of the principles involved are just a common sense approach to winery analysis. In fact, we can argue that it saves time! It has been reported that as much as 30% of winery lab analysis is repeated because winemakers do not have confidence in the results. If this rework could be reduced or eliminated by providing evidence of accuracy and precision, wouldn't that save your winery time and therefore money?

Myth:
Quality concepts are hard to understand

The quality field, like any other, is full of jargon. Anyone who isn't familiar with it is bound to find it daunting. Table I defines terms commonly used in quality circles. Many of these terms will be expanded in future columns. As a side note, don't worry, you don't need to be a whiz in statistics to have a quality system.

Now that we have dealt with the common myths of quality management, let's discuss the economic factors.

Quality as a form of insurance

Insurance provides a good analogy for explaining the benefits of a quality system. Everyone has some form of insurance to cover medical costs, car accidents, or theft. Though we all believe that nothing is going to happen to us, it helps us sleep better to know that, if something does happen, we have a financial safety net that will help us deal with it. Insurance protects us from the unknown. Some types of insurance (such as car insurance) are considered so important that the law requires them.

Having a quality system is like insurance, except the benefits are more easily identified and the potential returns are much greater. Just as insurance is a form of control over unknown events, quality system implementation is a form of control over the winemaking process.

As the term implies, quality *control* enables the winery to control the quality of the wine it produces. The system provides us with the information we need to make quality decisions.

For example, we all drive with a clean windshield. If we were to let the windshield get dirty, what would happen? The build up of dirt on the windshield would bias our view

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of the world, so eventually, we would not see clearly the direction in which we were heading. The outcome of this situation is likely to be catastrophic. Driving decisions would have been made without having a clear view of the whole picture.

How does this analogy relate to quality? Think of quality as the cloth that cleans the windshield. It is the tool that allows the winemaker to see the picture clearly by creating the best possible environment for good decision making.

A quality system also provides the framework for decision making at a lower level of the organization; that is, someone else can clean the windshield using the "quality" cloth, while you maintain control of the car. The quality system allows winemakers and senior staff to escape from the burden of day-to-day lab management issues, and use that time for other important activities.

Market forces

Market forces, particularly off-shore, will have a profound effect on the future of the wine industry. We often hear advertising executives talk about market forces without considering the implications at the production end of the food chain.

For example, as a result of the introduction of due diligence laws in the early 1990s, most importing supermarkets in the United Kingdom are keen to ensure that the products they sell, particularly those sold under their own labels, are free from any defect. This is because, the liability responsibility now rests with them. If someone finds a defect or a foreign object in a product they offer, or is injured by such a product in any way, the supermarket, not the original supplier, is exposed to potential litigation.

These buyers minimize their risk by insisting that their suppliers have adequate quality systems in place to minimize the risk of contamination of the product. Compliance can be demonstrated using a formal accredited quality system structure. Buyers worldwide are expected to adopt this initiative in the future to limit potential risk to consumers. It is not a question for the wine industry of *whether* it will occur and affect the sale of our wines, but *when* it will occur.

A quality system will, to a certain extent, protect your winery from the threat of liability and, at the same time, increase your potential opportunities off-shore.

A challenge

I can't predict how much your winery will save, either in actual dollars or as a percentage of expenditure, as a result of implementing a quality system, because each winery has different levels of quality exposure, depending on the management and staff of the laboratory.

A quality system, when implemented well, can save a winery thousands, if not millions, of dollars annually. However, don't just take my word for it. I challenge you to find a winery laboratory that has implemented a quality system and now regrets it.

Most winemakers have industry friends all around the world, so finding quality-minded wineries shouldn't be too difficult. I'll give a bottle of one of Australia's best reds to anyone who can obtain information that shows a winery that has implemented a quality system that has not resulted in increased efficiency, profitability, and opportunity. ■

Next issue: Down to the nitty gritty — Maintaining quality during harvest (or how to do it when you are busy).

Bibber International

Sue Weeks is an Australian wine laboratory consultant. She provides assistance in areas of formal or informal quality system implementation, method validation, and troubleshooting, laboratory setup, personnel selection, and staff training. She also facilitates international wine-industry training in conjunction with the Communicating for Agricultural Exchange Program (CAEP), in Fergus Falls, MN. She visits

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by D.R. Storm, PhD, P.E.

MANAGING CRISES

Winery general managers, CEOs, and COOs are often the first individuals in the organization to feel a "bump-in-the-road" or the pointy end of a sharp stick, called disaster. Even with a strong support staff and all the preparation in the world, crises do happen. Simply stated, a crisis can be any event that directly impacts the winery and its holdings with the potential to create major economic loss and/or adverse reaction from the public, the winery's customer.

A crisis event doesn't have to have the magnitude of an Exxon Valdez oil spill in Alaska to get a negative reaction from the general public and the immediate attention of news media. The U.S. Navy's seaman's credo of 40 years ago frequently voiced when things fell apart aboard ship … "when a crisis comes about you run around and scream and shout" should not describe your crisis management style in the year 2000. Instead, wineries and vineyards should plan in advance for dealing with crises.

What should your crisis management list include? Wineries have their sensitive aspects that cannot take a hit without major damage. Contaminating wines with ethylene glycol to increase wine volume 20 years ago nearly sank the Italian vintner whose method this was. It sent ripples of public disgust throughout the wine-consuming world.

Environmental disasters can also be high profile events. Landslides, flooding, pesticide drift, earthquakes, erosion and excessive sediment discharge, and threats to endangered species — all have the potential to raise a significant red flag of public resentment. There are certainly other crises that should be included in the winery's master list, such as worker death, cave collapse, sexual harassment, and more.

What's the solution? Wineries are required to have an Accident Prevention, Health Protection and Safety Plan, and a master plan for crises management would make a nice supplement to that.

The reference book, Crisis Management Planning and Media Relations for Construction and Engineering Firms *(1999) by Janine Reid is one resource that can help prime the winery administrative person tasked with the preparation of the crisis supplement. (You can contact Reid at 303/322-3211 or 72013.353@compuserve.com). Though the book is focused in a different field, the strategies Reid offers appear to be generic enough to allow their extrapolation to the wine industry.*

Fuel cells for fork lift power

General considerations

Propane- and battery-powered fork lifts predominate in the wine industry warehouse inventory. (They are discussed in detail in Chapter 9, *Winery Utility Systems: Planning, Design and Operation.*[2])

Fork lifts of both types work well in a winery's confined spaces (caves, warehouses, and barrel rooms), because the exhaust products for propane (or liquid petroleum gas [LPG]) units are a low level of CO_2 and CO, and the battery-powered lift trucks produce O_2 and H_2 only while being charged.[ibid]

Zinc/air fuel cells

Promoters are promising a new fuel source will be available for fork lifts in about three years. Called zinc/air fuel cells, their advantage is that they can be operated for three consecutive work shifts and then refueled as quickly and "as easily as pumping gasoline,"[3] to quote one of the fuel cell manufacturers. The cells provide zero-pollutant emission electric power with a power- (kilowatts/pound) to-weight ratio nearly 700% of that for conventional lead-acid wet cell batteries.[ibid]

Electrical energy is produced in these fuel cells by combining zinc pellets (0.5 to 0.8 mm diameter) with air in the presence of an aqueous potassium hydroxide electrolyte. (The same electrolyte that is found in safely-disposable alkaline batteries). The byproduct of the reaction is zinc oxide, an environmentally safe white powder used in cosmetic and sunblock preparations.

The fueling-zinc-recycling array is reported to be about the same dimensions as a service station gasoline pump. The refueling unit stores and recycles the zinc oxide back to elemental zinc, making it as close to a perpetual electricity producer as can be imagined, in my view.

Economics and Availability

Fuel cell manufacturer, Metallic Power, Inc., of Carlsbad, CA, estimates that a four-kilowatt unit (similar to the battery size required to power a 5,000-lb capacity fork lift) will be about the same price as a standard wet cell battery of the same power.

The 24-hour electrical stamina of the fuel cell and its 5-minute± refuel interval seem to offer an operational streamlining of the winery's fork lift system that would be difficult to beat. In addition to these advantages the current winery practice of purchasing multiple battery powered units and taking them out of service for eight hours to be recharged can be modified, which could provide major savings in fork lift truck capital expenditures.

It appears the zinc/air fuel cell is worth waiting three years for. Through this column, ***PWV*** will attempt to keep readers informed about developments in fuel cells for fork lifts. ■

David Storm is a consulting civil/sanitary engineer, who specializes in winery utility systems, is the author of the reference book, Winery Utility Systems: Planning, Design & Operation *and is owner of Winters Winery, Winters, CA.*

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Imagery Technology

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phenology, rootstock, and previous harvests. This will help with scheduling harvest machines, labor, hauling, and communicating with wineries. In addition, I will have the highlights of the contracts with the winery on each block for easy access during the stressful time of harvest."

In the future, the Orrs expect to be able to download multispectral satellite imagery via the Internet. With such imagery just a click away, David envisions using it several times each season to check vine growth in relation to application of irrigation and nutrients. Their goal is at least four satellite flyovers each year: at bloom, veraison, harvest, and just prior to leaf fall.

With their background and experience using imagery, the Orrs expect to better manage the entire ranch, save money, and have as much control as possible when producing high-quality grapes.

Imagery options on the horizon

In the future, with the successful launch of IKONOS II and with other high resolution satellites on the way, vineyard managers will have even more imagery options, including reliable, more affordable multiple acquisitions. With the possible price for unprocessed imagery of less than $1 per acre, there may be an incentive for even the most reluctant vineyard managers to jump into the imagery pool! ■

For more information:

VESTRA, Jamie Carothers, Ag Market Director, 530/223-2585; e-mail: *jamie@vestra.com;* website: *www.vestra.com*

GRAPES, 1993–1995 study of vineyard damage by a root louse, phylloxera *http://geo.arc.nasa.gov/sge/grapes/grapes.html*

CRUSH, 1997 study of how image analysis NDVI values relate to wine quality *http://geo.arc.nasa.gov/sge/crush/crush.html*

VINTAGE, *http://geo.arc.nasa.gov/sge/vintage/vintage.html*

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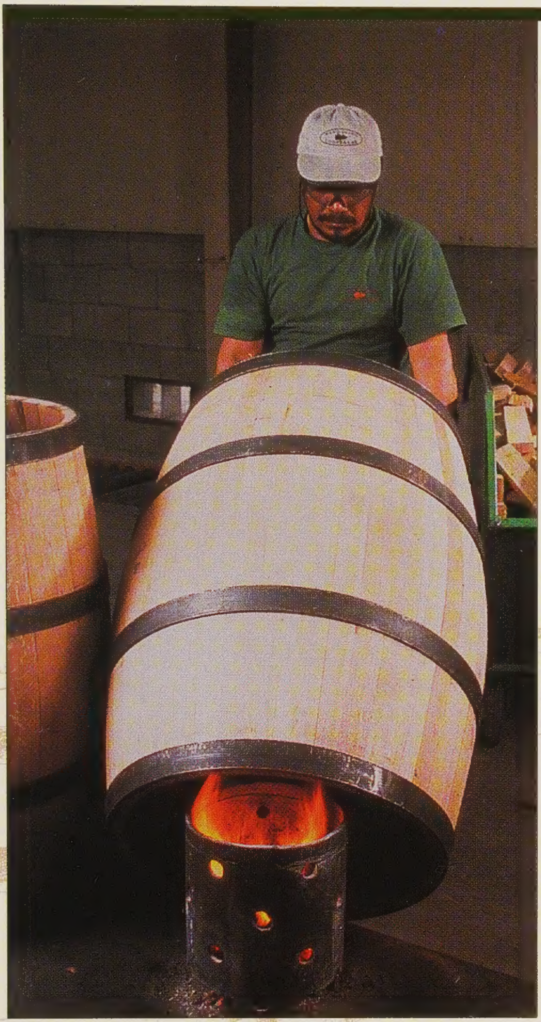

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